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Table de renversement
Manuel de l'usager

Préparé pour le
Centre de développement
des transports
Transports Canada

par le
Centre de recherche industrielle du Québec

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MANUEL DE L'USAGER

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AVERTISSEMENT

"Le contenu du présent rapport ne reflète que les opinions de l'auteur et ne saurait en aucun cas engager les politiques et positions officielles du Centre de recherche et de développement, Transports Canada."

Les données, descriptions et procédures contenues dans ce manuel s'appliquent à la table de renversement telle que construite et livrée au Centre d'essais des véhicules de Transports Canada à Blainville.

Si pour une raison ou l'autre des modifications sont apportées à cette table, il est de la responsabilité des usagers de maintenir à jour ce manuel.

AVIS

An English summary of this report is included immediately preceding the table of contents.

Also available in English under the title: "Tilt table: user's manual", TP 7522E.

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17 Resume

Une table de renversement a été conçue, construite et mise sur pied pour Transports Canada. Cet appareil d'essai est une plate-forme inclinable latéralement sur laquelle les camions lourds sont installés afin de déterminer leur seuil de renversement.

Le présent manuel présente une brève description de la table et contient toutes les instructions pour son installation, son utilisation et son entretien. Il contient également des schémas de principe du système hydraulique, du système électrique et des plateaux de mesure.

Les spécifications techniques des composantes sont présentées en annexe.

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17. Abstract

A tilt table has been designed, built and installed for Transport Canada. This test equipment is basically a laterally tilting platform on which heavy vehicles are driven and inclined in order to determine their rollover threshold.

This manual provides a brief description of the tilt table and its installation, operation and maintenance. It also contains schematic diagrams of the hydraulic and electrical systems and the weighing pads.

Technical specifications of the components are presented in annexes.

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SOMMAIRE

Le "Manuel de l'usager" de la table de renversement construite pour Transports Canada couvre tous les aspects de son installation, son utilisation et son entretien.

Il décrit en détail les différentes étapes de l'installation de cette table à un nouveau site d'essai ainsi que tous les ajustements alors nécessaires. Les vérifications devant être faites avant chaque nouvelle série d'essais afin de s'assurer du bon fonctionnement de la table y sont énumérées. Enfin, l'entretien périodique des différents systèmes est passé en revue de même que les précautions nécessaires pour l'entreposage. Les schémas, les listes de pièces et les spécifications techniques des composantes complètent le manuel.

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SUMMARY

The "Tilt table - user's manual" covers all the aspects of the installation, use and maintenance of the tilt table built for Transport Canada. It describes in details all the steps one must go through to install the table at a new test location along with all the adjustments then needed. All the verifications which must be done before each new series of tests in order to make sure the table will work properly are enumerated. Finally, the periodic maintenance of the table is described with the special care recommended for its storage. The schematic diagrams, the bill of materials and the components, technical specifications complete this manual.

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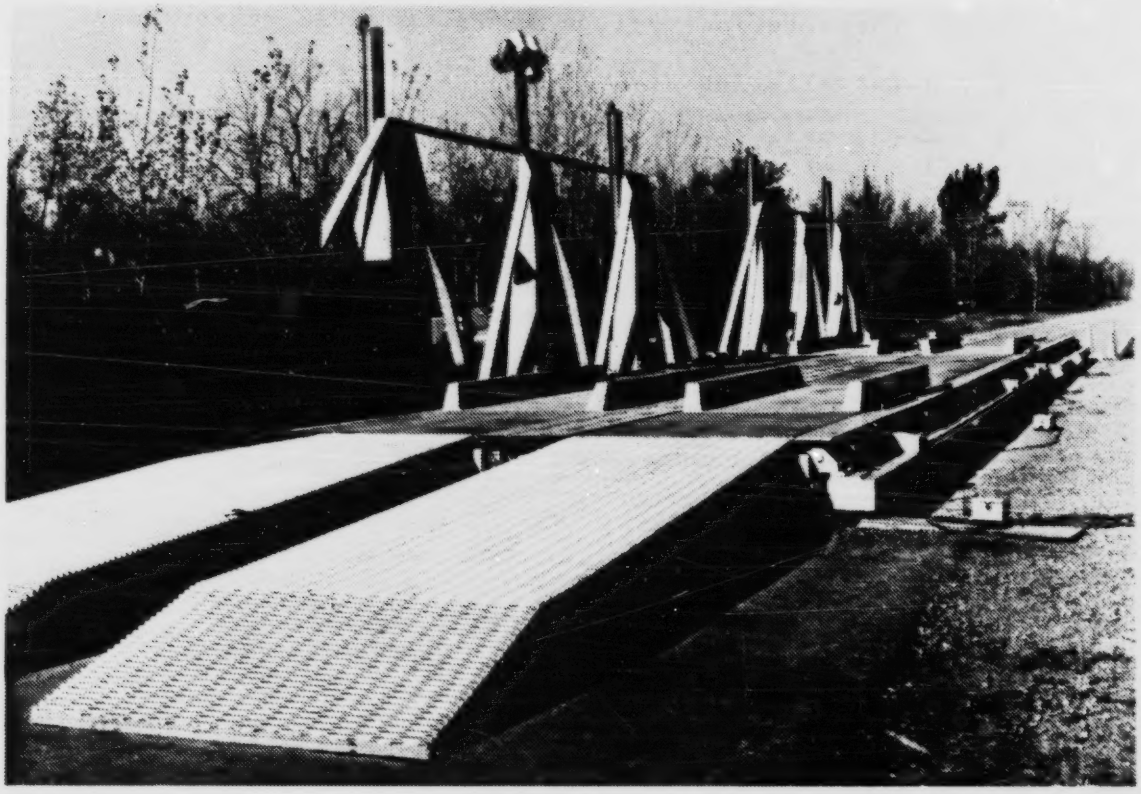

TABLE DE RENVERSEMENT

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1.0 TABLE DE RENVERSEMENT

1.1 Description

Une table de renversement est un appareil d'essai destiné à vérifier le seuil de renversement latéral des véhicules, spécialement les camions de transport et les autobus. Elle se compose essentiellement d'une plate-forme inclinable latéralement sur laquelle on place les véhicules à l'essai.

La table fabriquée pour Transports Canada est conçue pour être simplement déposée sur un sol solide et relativement de niveau. Elle se compose de deux demi-bases attachées bout à bout et supportant chacune une demi-plate-forme inclinable. Des rampes d'accès complètent l'ensemble de la structure de la table de renversement. Les équipements hydrauliques, à l'exception des quatre vérins, sont regroupés sur un châssis qui s'installe près de la table du côté des vérins. Cinq plateaux de pesage pouvant se déplacer longitudinalement permettent de mesurer la charge supportée par les différents groupes d'essieux du véhicule à l'essai. Quelques contrôles électriques complètent l'ensemble.

La figure 1 montre l'ensemble général de la table de renversement.

1.2 Dimensions et poids

En opération, la table de renversement proprement dite mesure 24,5 m de longueur sur 4,3 m de largeur; à ceci, il faut ajouter à chaque extrémité 4,6 m pour les rampes d'accès ce qui fait une longueur totale de 33,6 m. Il faut en plus prévoir un espace sur le côté des vérins pour l'instrumentation et les contrôles. La longueur d'alignement des véhicules dépend de l'espace disponible mais d'une façon générale, elle doit être d'environ 80 mètres pour un camion semi-remorque; pour un camion conventionnel et un autobus, on pourrait s'accommoder d'environ 30 mètres. Le schéma de localisation typique donné à la figure 2 indique toutes les dimensions importantes.

Les différents sous-ensembles de la table de renversement n'ont jamais été pesés, mais leur poids respectif est estimé comme suit:

- base complète (2 demi-bases) 4 820 kg
- plate-forme mobile complète (2 parties) 18 900 kg

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- rampes d'accès (4 pièces)	3 900 kg
- plateaux de pesage (5 plateaux)	4 225 kg
- madriers de bois (105 madriers)	1 910 kg
- vérins hydrauliques (4 vérins)	580 kg
- groupe hydraulique (sans huile)	980 kg
- ensemble d'attaches	250 kg
- câbles et accessoires de câblage	150 kg
- contrôles et divers	25 kg
Poids total	35 740 kg

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2.0 INSTALLATION

2.1 Préparation du terrain et installation des structures

A l'endroit choisi pour l'installation, le sol doit être relativement de niveau, c'est-à-dire qu'il ne doit pas présenter une pente de plus de 0,4% sans quoi il sera impossible d'ajuster la table au niveau avec seulement les vis des pieds-supports. La résistance mécanique du sol doit être au minimum de 75 livres par pouce carré sous la table et sous les rampes d'accès; le pavage des approches doit pouvoir supporter le trafic lourd.

Les dimensions de l'espace prévu doivent permettre l'alignement des véhicules avant leur montée sur la table et suffisamment d'espace du côté de la descente pour que les véhicules quittent la table en ligne droite. Se référer à la figure 2 pour une installation typique de la table de renversement.

2.2 Assemblage de la structure de la table

La table est transportable par des camions semi-remorques ayant des plates-formes de chargement de 40 pieds et plus. Généralement, pour le déménagement, la table sera démontée en deux sous-ensembles majeurs; les bases et les plates-formes mobiles demeurant assemblées une à l'autre par les cinq pivots. Ceci donne des structures d'une longueur totale de 12,2 m (40 pieds) et d'une largeur totale de 4,3 m (14 pieds).

Pour l'installation à un nouvel endroit, il est recommandé de suivre la procédure suivante:

- Sortir toutes les vis d'ajustements de hauteur de chaque base d'environ 5 cm par rapport au-dessous du châssis.
- Placer les 10 pieds-supports (plaque de 40 cm x 40 cm servant à supporter la table) approximativement où ils seront localisés une fois la table installée.
- A l'aide d'une grue et d'attaches appropriées, prendre les sous-ensembles bases et plates-formes et les amener à l'endroit désiré. Faire attention de placer les bases dans le bon ordre, c'est-à-dire avec les trous pour les boulons de liaison au centre de la table.

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- Déposer le tout au sol en prenant soin d'engager chaque vis-support dans les guides des pieds-supports.
- Aligner les deux bases et ajuster la hauteur des supports de façon à ce que les dix pivots des deux plates-formes soient en ligne et que la surface des plates-formes soit au niveau.
- Positionner les quatre rampes d'accès à chaque extrémité de la table et ajuster la hauteur de leurs supports de façon à ce que la hauteur de chaque rampe corresponde à celle de la table.
- S'ils ont été démontés pour le transport, installer les quatre vérins hydrauliques; à noter que les deux vérins près du centre de la table doivent être montés avec des cales d'épaisseur à chacun de leur pivot de façon à éliminer le jeu latéral des vérins.

Les boulons de jonction des deux bases sont installés seulement lorsque le système hydraulique est fonctionnel de façon à éviter de soulever les plates-formes avec une grue.

Dans le cas où les bases auront été séparées des plates-formes, on installera d'abord les bases au niveau en prenant soin de joindre les deux pièces avec les six boulons de liaison puis on ajoutera les deux plates-formes. Il est nécessaire de replacer chaque plate-forme sur la base où elle était auparavant car les interrupteurs de détection de niveau et de synchronisation ne sont pas symétriques. De plus, il est possible que les tolérances de fabrication d'une structure de cette dimension rendent l'interchangeabilité des deux plates-formes difficile.

2.3 Installation des équipements hydrauliques

Positionner le groupe hydraulique près du bout de la table, du côté des vérins, là où il y a les trois raccords hydrauliques. Placer des pièces de bois entre le châssis du groupe et le sol de façon à ce qu'il repose solidement au sol et qu'il soit de niveau.

Raccorder les quatre boyaux hydrauliques flexibles provenant du groupe hydraulique en respectant l'ordre suivant:
- boyau no 1, directement au cylindre no 1;
- boyau no 2, au tuyau du haut (vers vérin no 2);

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- boyau no 3, au tuyau central (vers vérin no 3);
- boyau no 4, au tuyau du bas (vers vérin no 4).

Raccorder les deux boyaux flexibles au centre de la table pour assurer l'alimentation des vérins nos 3 et 4.

2.4 Installation des équipements électriques

2.4.1 INSTALLATION DES DÉTECTEURS DE NIVEAU DES PLATES-FORMES

Installer les deux boîtiers de contrôle du niveau des plates-formes et les barres de référence sur les cylindres nos 2 et 3. Ces boîtiers s'installent simplement avec deux brides autour des vérins et le branchement électrique se fait sur le bornier à l'intérieur du boîtier; la barre de référence se fixe au tourillon. La hauteur du boîtier doit être ajustée de façon à ce que l'aiguille solidaire du tourillon s'engage dans le boîtier et actionne les quatre interrupteurs. La figure no 3 montre l'installation correcte.

A la jonction des deux demi-plates-formes, installer les deux interrupteurs de contrôle de la synchronisation des plates-formes. La figure no 4 montre l'arrangement de ces interrupteurs. Le raccordement électrique se fait directement à l'intérieur du boîtier de ces interrupteurs étanches. Sur la plate-forme opposée, installer les crans d'actuation des interrupteurs.

Finalement, raccorder le câble flexible entre les deux demi-bases; il se raccorde directement à l'intérieur des boîtes de jonction.

L'inclinomètre et les plateaux de pesage sont raccordés uniquement durant les essais directement aux instruments de mesure.

2.5 Installation des plateaux de pesage

Les plateaux de pesage sont simplement déposés n'importe où dans les canaux des plates-formes. La seule précaution est d'orienter chaque plateau de façon à ce que sa prise pour le raccordement électrique soit orientée vers le centre de la plate-forme.

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Lorsque la table est utilisée, les câbles de mesure se raccordent à la prise multibroche du plateau de pesage et cheminent dans les caniveaux prévus à cet effet au centre de la plate-forme; la figure 5 montre l'installation des plateaux.

La voie de roulement entre les plateaux de mesure est pavée avec les madriers de bois de 10 x 30 x 120 cm (4 x 12 x 47 po).

Normalement, les tubes de 4 x 6 po sont placés du côté des vérins; ceci donne une largeur de voie de 2,6 m (102 po). On peut élargir la voie de roulement jusqu'à 2,9 m (114 po) en plaçant ces tubes au centre de la table.

2.6 Ajustement et mise en marche

Une fois la table installée, il faut vérifier et ajuster de façon définitive le niveau de la plate-forme à l'aide des pieds-supports. En tout temps, on doit maintenir la table au plus bas niveau possible et s'assurer que tous les supports sont bien appuyés au sol. Il faut également ajuster la hauteur des rampes d'accès.

On ajuste par la suite les interrupteurs des contrôleurs de niveau selon la procédure suivante:

- On vérifie que le boîtier est centré sur le cylindre de façon à ce que la barre de référence attachée au tourillon soit au centre de l'ouverture dans le fond de la boîte.
- L'aiguille d'extension de la barre dans la boîte est ajustée de façon à ce qu'elle soit au centre des quatre interrupteurs; cet ajustement est possible par le jeu des quatre vis d'attachement.
- On ajuste les deux interrupteurs du haut de chaque boîtier de façon à ce que la réouverture de chaque interrupteur se fasse le plus près possible de la position de repos central; à ce moment, l'enclenchement des contacts se fait avec moins de 2 mm de déplacement de l'aiguille. La figure 6 donne la disposition des interrupteurs dans chaque boîtier et illustre leur ajustement.
- Les interrupteurs du bas sont ajustés pour que la fermeture des contacts se fasse à environ 6 mm de l'aiguille. L'ajustement de ces derniers est moins critique car ils interviennent seulement pour indiquer que les circuits de correction ne réussissent

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pas à ramener la table à un niveau acceptable et qu'on doit arrêter la montée ou la descente.

Afin d'éliminer l'effet des jeux dans les pivots, les ajustements précédents peuvent se faire avec la table soulevée de quelques dix centimètres mais toujours de niveau longitudinalement.

L'ajustement des interrupteurs de synchronisation des deux demi-plates-formes, localisés au centre de la table, se fait comme suit (voir figure 4):

- Ajustement des leviers des interrupteurs dans une position horizontale.
- Pour l'interrupteur intérieur (S5), ajustement de chaque ergot avec un jeu de 3 mm par rapport à la roulette.
- Pour l'interrupteur extérieur (S6), ajustement de chaque ergot avec un jeu de 10 mm par rapport à la roulette.

Après avoir vérifié le niveau d'huile dans le réservoir hydraulique, la pompe peut alors être mise en marche pour la purge des cylindres. Au début, on purge les cylindres en ouvrant les valves de purge au maximum et en commandant la montée de la table; lorsque l'huile commence à sortir des valves de purge, on arrête, on ferme les valves de purge et on passe à la purge fine. Celle-ci consiste à soulever les plates-formes d'environ 15 cm avec toutes les valves de purge fermées; on ouvre alors chaque valve lentement et on laisse sortir l'air. Après avoir répété à chaque cylindre jusqu'à ce qu'il n'y ait plus d'air, on opère la table à vide pour quelques cycles, on laisse reposer le système et on répète la purge fine une seconde fois. Il est normal que la table descende lentement lorsqu'il n'y a pas de charge; de plus, lorsque la température est basse, la vitesse de descente peut être très lente.

Il est recommandé de répéter la purge fine après un certain temps afin de s'assurer que tout l'air emprisonné dans le système est bien éliminé. Une façon alternative est de brancher des boyaux de retour au réservoir à chaque valve de purge et de faire circuler une quantité importante d'huile à travers les cylindres. Cette technique est recommandée si l'on a de la difficulté à se débarrasser de la présence d'air dans le système.

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3.0 UTILISATION

3.1 Préparation pour essais

3.1.1 VÉRIFICATION DU GROUPE HYDRAULIQUE

Avant de débuter une série d'essais alors que la table a été inutilisée pendant un certain temps, il faut vérifier les points suivants sur le groupe hydraulique:

- niveau d'huile dans le réservoir;
- niveau de carburant pour le moteur;
- niveau d'huile dans le carter du moteur;
- niveau de liquide dans le radiateur du moteur;
- niveau d'électrolyte dans la batterie;
- pression disponible: elle doit être de 2000 psi à 1800 rpm;
- purge.

Il faut aussi opérer la table à vide et vérifier pour fuites et fonctionnement anormal. Pour démarrer le moteur sans charge, il faut ouvrir au drain la valve de la pression pilote du régulateur de pression.

3.1.2 VÉRIFICATION DES CONTROLES ÉLECTRIQUES

En opérant la table à vide, vérifier la réponse de la table aux commandes "montée et descente" et vérifier la bonne synchronisation des cylindres. Une bonne façon de vérifier le fonctionnement des circuits de synchronisation est d'actionner manuellement les détecteurs de niveau et de vérifier que les mouvements des cylindres qui s'en suivent, tendent à corriger l'erreur simulée. Si la vitesse de correction est trop lente ou trop rapide, ajuster les quatre (4) contrôleurs du débit correcteur sur le groupe hydraulique.

3.1.3 VÉRIFICATION DES PLATEAUX DE PESAGE

Après avoir raccordé les plateaux prévus pour utilisation et procéder à la calibration des circuits de mesure, il est recommandé de vérifier la réponse des plateaux à un poids connu ou du moins la réponse des plateaux à un même poids.

La conception même des plateaux de mesure est telle que les cellules de charge supportent la presque totalité du poids des plateaux de pesage; de plus, seulement la composante normale à la surface de la table

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influence les cellules. L'ajustement du zéro de l'appareil de lecture permet d'éliminer le poids initial sur les cellules, mais lorsque la table s'incline, il faut apporter une correction pour tenir compte de la diminution de la composante normale du poids du plateau. Ainsi, le signal total d'un plateau supportant une charge perpendiculaire $C_{per.}$ est donnée par:

SIGNAL = $C_{per.}$ - POIDS DU PLATEAU x (1-cosA)
où A = angle d'inclinaison par rapport à l'horizontal

Si la charge est nulle et que la table est levée à vide, la lecture diminue en fonction de l'angle de levage. Ainsi, après avoir ajusté la lecture à zéro en position horizontale, on lira une charge négative de:

-11 kg à 10 degrés
-45 kg à 20 degrés
-100 kg à 30 degrés

lorsqu'on incline les plateaux sans charge.

Lors de l'interprétation des résultats, il ne faut pas oublier de faire la correction des lectures selon l'équation suivante:

$C_{per.}$ = LECTURE + POIDS DU PLATEAU x (1-cosA)

3.2 Opération de la table

3.2.1 LOCALISATION DES PLATEAUX DE PESAGE

La synchronisation des vérins hydrauliques nécessite des corrections moins fréquentes lorsque la charge sur chaque vérin est approximativement égale. Même si ces corrections se font automatiquement, on obtient une montée plus uniforme lorsque la différence de charge sur les vérins est faible. On doit donc positionner le véhicule à l'essai de façon à ce qu'il repose sur les deux plates-formes avec les résultantes des charges sur chaque plate-forme le plus près possible du centre de chaque plate-forme.

On mesure les empattements entre les groupes d'essieux et on positionne les plateaux de pesage en conséquence. Généralement, pour une semi-remorque conventionnelle, les roues arrière seront sur une plate-forme et le tracteur sur l'autre; la condition

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à éviter étant un seul groupe d'essieux près de l'extrémité d'une plate-forme. En aucun temps, on ne doit dépasser la capacité de chaque plate-forme donnée à la figure 8.

3.2.2 INSTALLATION DU CAMION

Le camion est avancé sur la table de renversement en l'enlignant le plus possible vers le côté bas du chemin de roulement. Ceci permet d'appuyer les pneus contre les rebords des plateaux de pesage et d'éviter tout glissement lors des essais. S'il y a des pneus qui ne prennent pas appui contre le rebord d'un plateau de pesage, il est recommandé de fixer une butée aux madriers transversaux afin d'empêcher le glissement possible de l'essieu.

Par la suite, il faut installer les chaînes de retenue du côté des vérins afin d'empêcher que le camion ne se renverse complètement. Chaque plate-forme est pourvue d'une série de crochets sur le plancher du côté haut dans lesquels on peut attacher plusieurs chaînes de retenue. Le problème est souvent les points d'attache sur le camion même. Si la remorque possède des crochets latéraux solides, il est préférable d'attacher la remorque à la table avec plusieurs chaînes suffisamment longues pour permettre l'étirement des suspensions. Six à huit pouces de jeu sont généralement suffisants, mais il est préférable de recommencer l'essai avec plus de jeu que d'en avoir trop au début. Si la remorque ne possède pas de crochets latéraux, on doit alors utiliser les attaches spéciales s'installant autour des pneus; dans ces cas, il faut que la retenue verticale des suspensions soit suffisamment solide. L'installation de ce système d'attaches débute par la pose d'une bande repliée munie de crochets au-dessus d'un pneu, intérieur ou extérieur, des essieux. On installe par la suite des chaînes entre les crochets et les points d'ancrage de la table; la figure 7 montre l'arrangement recommandé pour les chaînes selon la position respective des essieux et des crochets sur la table. En tout temps, il faut éviter que les tensions dans les chaînes tendent à ouvrir les bandes qui retiennent les pneus. Avec ce type de fixations, le jeu des chaînes est plus petit car il prévoit seulement le relèvement des pneus.

Enfin, pour les camions ne pouvant s'accommoder ni de l'une ni de l'autre des méthodes précédentes, on

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pourra retenir ces derniers à la table avec une série de bandes (straps) encerclant le camion et son chargement.

Il faut se rappeler qu'au point de renversement, le véhicule est en équilibre instable sur les roues basses et qu'alors le système de retenue n'est théoriquement pas sollicité. Cependant, si on dépasse ce point ou, encore pire, s'il y a un affaissement soudain de la suspension ou un déplacement de la charge, les forces de retenue nécessaires peuvent devenir très grandes. Il est donc toujours très important de prévoir le maximum d'attaches, de s'assurer que la charge est solidement retenue au camion et d'opérer la table lentement près du seuil de renversement.

3.2.3 ESSAI DE RENVERSEMENT

Après s'être assuré que le système de mesure des charges et de l'angle d'inclinaison est en marche, l'opérateur incline la table en enfonçant et en maintenant enfoncé le bouton de montée. Il doit surveiller le comportement de la table et s'arrêter si l'alarme indiquant une mauvaise synchronisation des vérins entre en fonction ou s'il décèle un problème quelconque; en tout temps, le champignon d'urgence peut être utilisé pour bloquer tout le système. Il est préférable d'opérer la table à la vitesse lente, levier de contrôle en bas, car les corrections pour la synchronisation des vérins sont alors relativement rapides et on risque moins d'atteindre une condition limite. Ceci est spécialement vrai lorsqu'on opère avec un camion ne permettant pas une bonne distribution des charges sur les deux plates-formes. En arrêtant la montée ou la descente immédiatement lorsque l'alarme se fait entendre, les circuits hydrauliques correcteurs auront toujours la capacité de ramener les plates-formes à l'intérieur des limites acceptables.

Il faut s'assurer qu'il y a toujours assez de carburant pour le moteur car même si la table descend sous son propre poids, il faut de la pression pour ouvrir la valve de descente et les clapets pilotés. Dans le cas où on doit descendre la table en absence de pression, on devra maintenir manuellement fermé l'interrupteur sous la plate-forme no 1 près du centre. Ceci ouvre les valves de correction et la table descend lentement; on doit alors faire très attention à ce que les plates-formes demeurent synchronisées et de niveau car le système correcteur est alors hors cir-

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cuit. Si on atteint une mauvaise synchronisation, on doit alors relâcher l'interrupteur ce qui remet en fonction le système correcteur et attendre que la correction s'effectue.

Il faut éviter de provoquer des oscillations du camion et une montée à vitesse lente et constante donne les meilleurs résultats. Au début de la montée, la compressibilité de l'huile occasionne souvent un léger retard dans la montée du(des) vérin(s) le(s) plus chargé(s). On doit alors arrêter la montée après quelques 10 cm de levée et laisser le temps aux circuits correcteurs d'agir.

En abaissant le camion, il est très important d'arrêter la descente lorsque l'alarme se fait entendre car il est possible qu'un vérin très peu chargé descende plus lentement qu'un vérin voisin chargé même si le circuit correcteur est en fonction; cette condition se rencontre lorsqu'il n'y a pas dans le vérin suffisamment de pression pour provoquer un écoulement rapide.

3.2.4 DÉBARQUEMENT DU CAMION

Après que les deux plates-formes de la table soient revenues à leur position initiale, on peut détacher le camion et le descendre de la table simplement en avançant tout droit sur les rampes à l'extrémité de la table.

3.3 Capacités de la table

La table de renversement est prévue pour opérer dans les conditions suivantes lesquelles ne devraient jamais être excédées:

Angle maximal:	35 degrés
Vitesse de levage:	35 degrés en 70 secondes, table à vide et vitesse rapide. 35 degrés en 135 secondes, table à vide et vitesse lente.
Vitesse de descente:	Elle dépend de la charge sur la table et de la température de l'huile. Sans charge et à basse température, elle descend très lentement, environ 250 secondes. Cependant avec un camion

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typique et une température ambiante de 18 °C, elle descend de 20 degrés à 0 à la vitesse rapide dans environ 70 secondes.

Charge maximale:

La charge maximale que peut supporter la table dépend de la répartition de celle-ci. Si elle est uniformément répartie, la charge totale peut atteindre 135 000 kg, soit 67 500 kg sur chaque plate-forme. Cependant, il faut limiter la charge axiale à 12 000 kg par essieu. D'autre part, afin de ne pas excéder la capacité de chaque vérin, il faut que la résultante des charges sur chaque plate-forme soit moindre que la charge limite pour cette position donnée par la figure 8.

Plateaux de mesure:

Chaque plateau de mesure est supporté par quatre cellules de charge d'une capacité de 11 400 kg (25 000 lb) installées au quatre coins du plateau. Ceci donne une capacité totale de 45 000 kg lorsque la charge est bien répartie. Cependant, au point de renversement d'un véhicule, la charge totale des essieux est transportée sur le plateau inférieur; trois essieux de 12 000 kg approchent alors la capacité des cellules du côté inférieur du plateau.
La spécification des cellules de charge est donnée à l'annexe C.

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4.0 ENTRETIEN

4.1 Entretien périodique

4.1.1 ENTRETIEN DE LA STRUCTURE MÉTALLIQUE

La structure métallique requiert très peu d'entretien. Afin d'éviter la corrosion, il est recommandé de faire les retouches de peinture nécessaires sur une base annuelle. Également, vérifier le niveau et le bon alignement des bases et plates-formes à chaque printemps après le dégel. A ce moment, lubrifier avec de la graisse les vis des pieds-supports et s'assurer qu'ils tournent toujours librement; mettre un peu d'huile légère sur les pivots des plates-formes et ceux des vérins.

4.1.2 ENTRETIEN DU SYSTÈME HYDRAULIQUE

4.1.2.1 Entretien du moteur

L'entretien annuel courant consiste à:
- vidanger l'huile du carter;
- changer le filtre d'huile;
- vérifier et changer au besoin le filtre d'aspiration d'air;
- vérifier le niveau de l'antigel dans le radiateur;
- vérifier le degré de protection de l'antigel;
- vérifier le niveau et la densité de l'électrolyte dans la batterie;
- vérifier le bon fonctionnement du circuit de charge de la batterie;
- vérifier le bon fonctionnement du système d'arrêt automatique du moteur: pour ce faire, simuler une perte de pression d'huile et une surchauffe du moteur (débrancher le senseur de pression d'huile et court-circuiter à la masse le senseur de température). Ceci coupe l'alimentation du carburant et le moteur s'arrête peu après.

Si on utilise fréquemment le moteur, la vidange de l'huile et le remplacement du filtre doivent se faire à toutes les 50 heures de marche.

Se référer au manuel d'entretien de la compagnie Ford pour plus de détails. Les recommandations de ce dernier ont priorité sur toutes autres directives en ce qui concerne l'entretien du moteur.

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4.1.2.2 Entretien des autres éléments du système hydraulique

Les principales vérifications devant être faites sur les autres composants du système hydraulique lors de l'entretien annuel sont:
- vérification du niveau d'huile dans le réservoir hydraulique;
- vérification des raccordements de la tuyauterie pour bon état et étanchéité.

4.1.3 ENTRETIEN DES ÉQUIPEMENTS ÉLECTRIQUES

Les équipements électriques ne requièrent pas d'entretien particulier sauf la vérification que les protections mécaniques du câblage n'ont pas été endommagées accidentellement; ceci doit être fait lors de l'entretien annuel.

4.1.4 ENTRETIEN DES PLATEAUX DE PESAGE

L'entretien annuel des plateaux de pesage consiste en:
- la retouche de peinture pour éviter la progression de la corrosion;
- la vérification du libre mouvement des étriers et des bras de localisation;
- la lubrification des pivots en vaporisant une huile légère;
- la vérification de la présence des bouchons sur les prises multibroches.

4.2 Entreposage

Normalement, la table de renversement peut être laissée à l'extérieur sans précaution particulière. Cependant, il faut s'assurer que:
- l'antigel offre un niveau de protection adéquat pour les températures minimales prévues lors de l'entreposage;
- la batterie est débranchée et qu'elle est suffisamment chargée pour que son électrolyte ne risque pas de geler;
- les prises multibroches des plateaux de pesage sont munies d'un bouchon étanche.

Il est recommandé de couvrir d'une bâche le groupe hydraulique et d'entreposer à l'intérieur le boîtier de contrôle, les câbles des plateaux de pesage, les attaches et la batterie. Afin de prolonger la vie des madriers de bois, ceux-ci devraient être sortis des caniveaux, empilés de façon ajourée sur la table et recouverts d'une bâche.

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5.0 SCHÉMA DE PRINCIPE

5.1 Système hydraulique

Le système hydraulique de la table de renversement utilise un moteur diesel comme source d'énergie primaire. La pompe à débit compensé fournit jusqu'à 115 litres/minute (30 gallons/minute) à 1800 rpm. En examinant la schéma de principe de l'annexe A, on constate que lors de la levée de la table, l'huile est tout d'abord dirigée à travers un régulateur de débit lequel permet de contrôler la vitesse de renversement. Par la suite, l'huile traverse la valve principale, le clapet du régulateur de débit sens descente et elle atteint le diviseur de débit à engrenage. Celui-ci divise le débit de la pompe en quatre débits théoriquement identiques lesquels atteignent les vérins après avoir passé chacun un clapet piloté et une valve parachute. Les clapets pilotés bloquent positivement les vérins en position levée; ils empêchent les fuites d'un vérin avec haute pression vers un vérin voisin avec pression plus basse à travers le diviseur de débit. Les valves parachutes sont installées directement à l'entrée des vérins uniquement pour des raisons de sécurité; elles bloquent la descente des vérins aussitôt que le bris d'un tuyau engendre un débit élevé sortant du vérin. Pour débloquer une valve parachute, il faut appliquer une pression à l'entrée.

Sur le circuit de chaque vérin se branche un limitateur de pression et une valve d'égalisation avec retour au réservoir. Le rôle des limitateurs de pression est d'empêcher que le diviseur de débit, agissant comme amplificateur de pression, ne génère des pressions excessives spécialement en fin de course. La fonction première des valves d'égalisation est d'éliminer toute pression résiduelle dans les vérins à la fin de chaque descente. Étant donné que la précision du diviseur de débit, spécialement lorsqu'il travaille contre des pressions différentes, n'est pas suffisante pour assurer la synchronisation désirée des vérins, les valves d'égalisation sont également utilisées pour corriger la longueur des cylindres. On maintient tous les vérins à la même extension en drainant un peu d'huile du(des) vérin(s) détecté(s) trop long(s).

Les autres composants du système hydraulique comprennent le réservoir de 350 litres (90 gallons US), les filtres, un manomètre, un thermomètre, etc.

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Le schéma hydraulique, la liste des pièces et leurs spécifications sont donnés à l'annexe A.

5.2 Système électrique

Les éléments du système électrique de la table de renversement sont regroupés dans le boîtier de commande, la boîte de raccordement principale et les deux boîtiers détecteurs de niveau. On retrouve, de plus, deux interrupteurs de synchronisation des plates-formes et un interrupteur de fin de course.

Le schéma de principe de l'annexe B montre que le système opère à partir de la batterie 12 volts du moteur diesel; ceci rend son opération autonome et à l'abri des pannes du réseau.

Un interrupteur à clé, localisé sur le boîtier de raccordement principal (groupe hydraulique), permet la mise en fonction de tout le système. De plus, en tout temps, l'opérateur peut couper l'alimentation en enfonçant le champignon d'arrêt d'urgence.

Les boutons-poussoirs "montée" et "descente" interdisent l'alimentation simultanée des électrovalves "montée" et "descente".

L'interrupteur de fin de course FC est actionné lorsque la plate-forme no 1 revient à quelques centimètres seulement de sa position de repos; ceci permet l'alimentation des quatre valves d'égalisation pour quelques dix secondes par l'intermédiaire du relais temporisé T1.

Les interrupteurs S1, S2, S3 et S4 détectent le manque de niveau des plates-formes 1 et 2. En effet, lorsque la plate-forme no 1 s'incline, l'aiguille solitaire du tourillon, donc de la plate-forme actionne l'interrupteur S1 (ou S2) ce qui entraîne l'ouverture de la valve d'égalisation EQ1 (ou EQ2) et l'abaissement du cylindre no 1 (ou no 2) amenant ainsi la correction de niveau désirée. Les interrupteurs S3 et S4 jouent le même rôle pour la plate-forme no 2. Les interrupteurs S1A, S2A, S3A et S4A sont installés de la même façon que les précédents sauf qu'ils entrent en fonction avec un manque de niveau plus grand. Ils mettent alors en marche un avertisseur sonore et allument les voyants correspondant aux vérins trop longs avisant ainsi l'opérateur d'arrêter la montée ou la descente. Les interrupteurs à double action S5

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et S6 surveillent la hauteur des deux plates-formes; S5 agit sur les valves d'égalisation aussitôt qu'il détecte une différence de hauteur tandis que S6 signale que le défaut est devenu trop grand et avise l'opérateur d'arrêter.

Le schéma électrique, la liste des composantes et leurs spécifications techniques sont donnés à l'annexe B.

5.3 Plateaux de pesage

Chaque plateau de pesage est supporté par quatre cellules de charge de type poutrelle d'une capacité de 11 500 kg (25 000 lb). Les câbles des quatre cellules d'un même plateau sont dirigés vers une boîte de jonction centrale où ils sont raccordés à une prise multibroche. Cinq câbles d'environ 36 m avec prises multibroches à chaque extrémité sont inclus avec la table pour le raccordement des plateaux aux instruments de mesure.

Les spécifications des cellules et le schéma de raccordement des plateaux sont donnés à l'annexe C.

5.4 Conception de la table

La conception de la table est expliquée plus en détail dans le manuel de conception de la table de renversement (réf. 1).

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RÉFÉRENCES

1- Bédard, Jean T. "Table de renversement - Manuel de conception", Transports Canada, Centre de développement des transports, rapport no TP 7523F, mars 1986.

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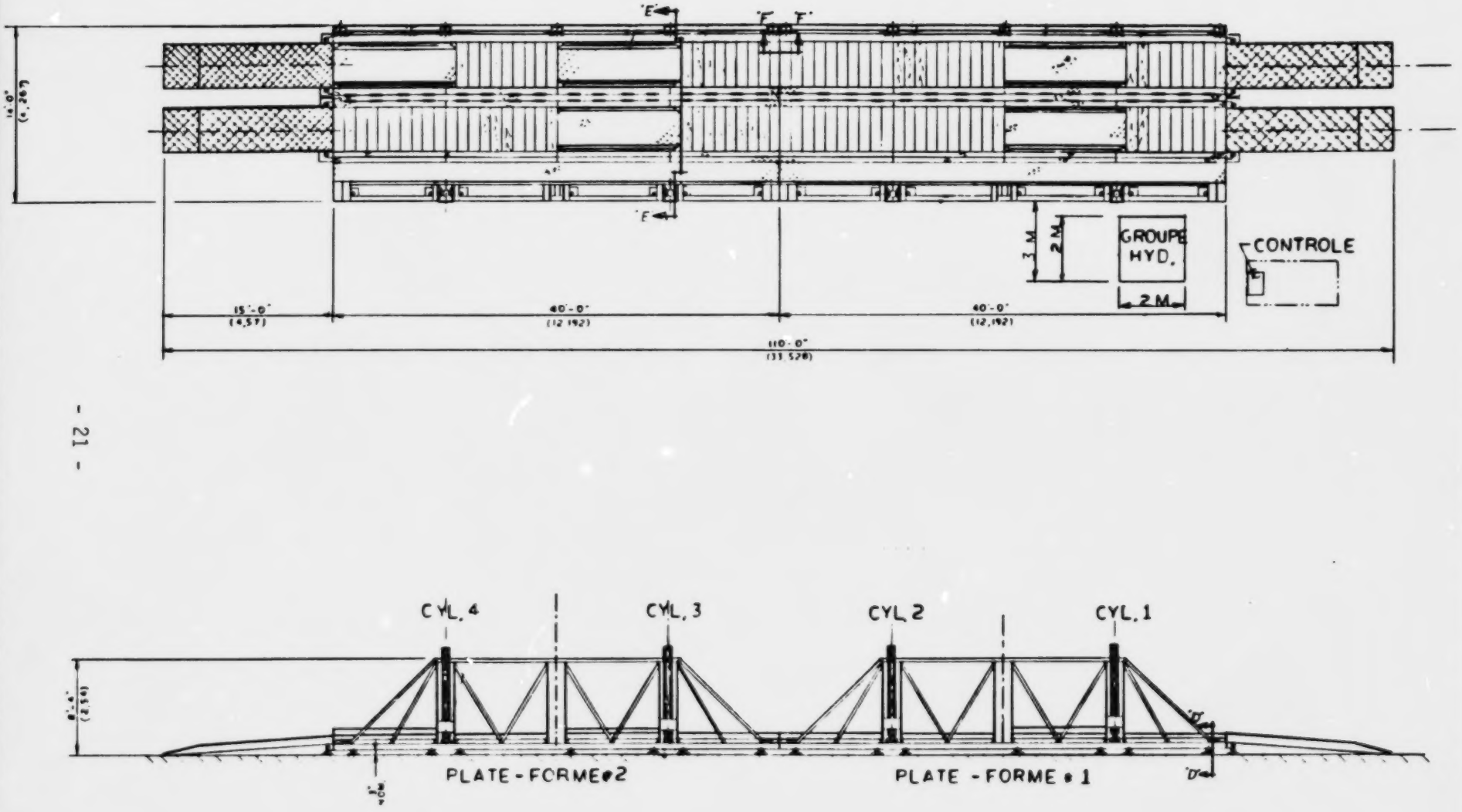


FIGURE 1: Ensemble général de la table de renversement.

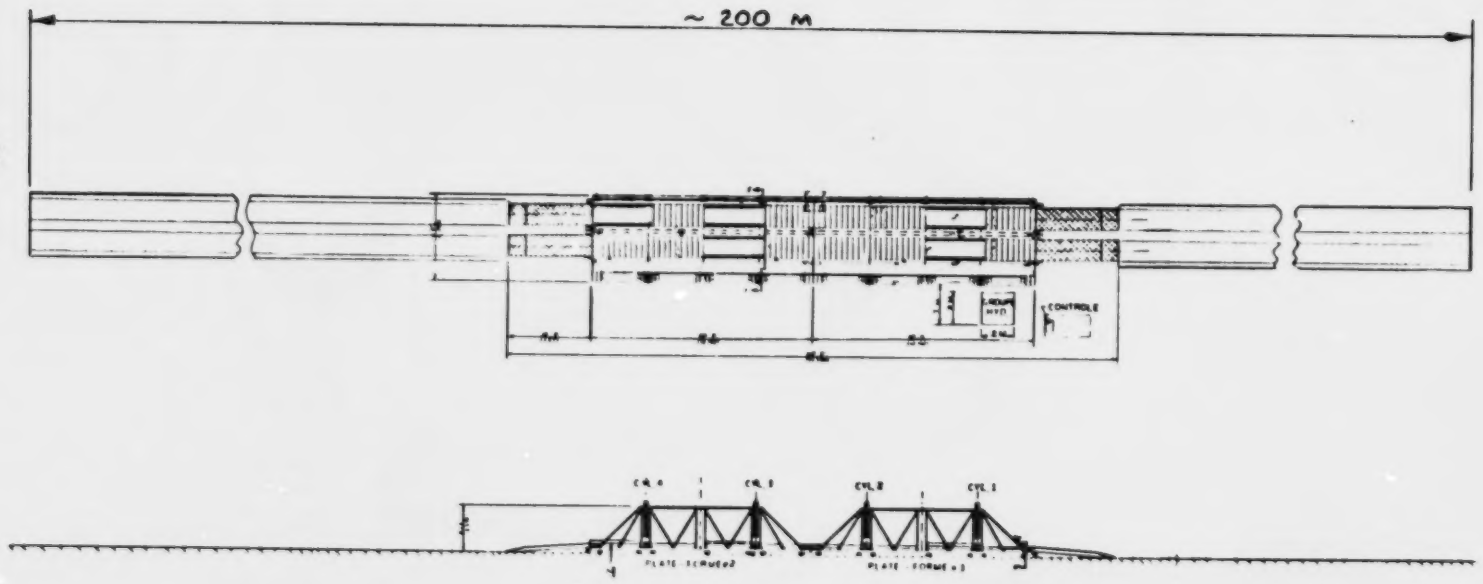


FIGURE 2: Installation typique de la table de renversement.

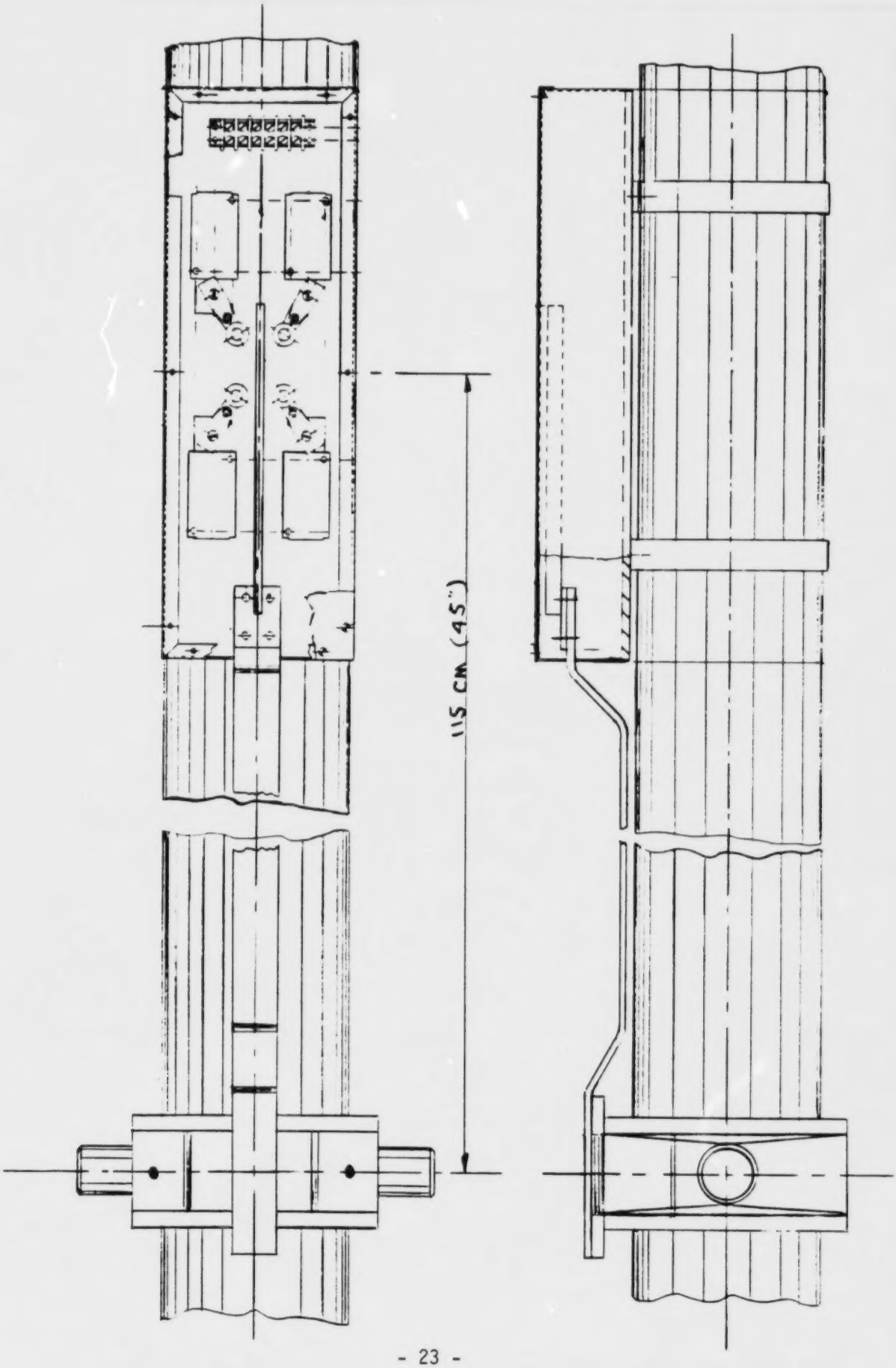
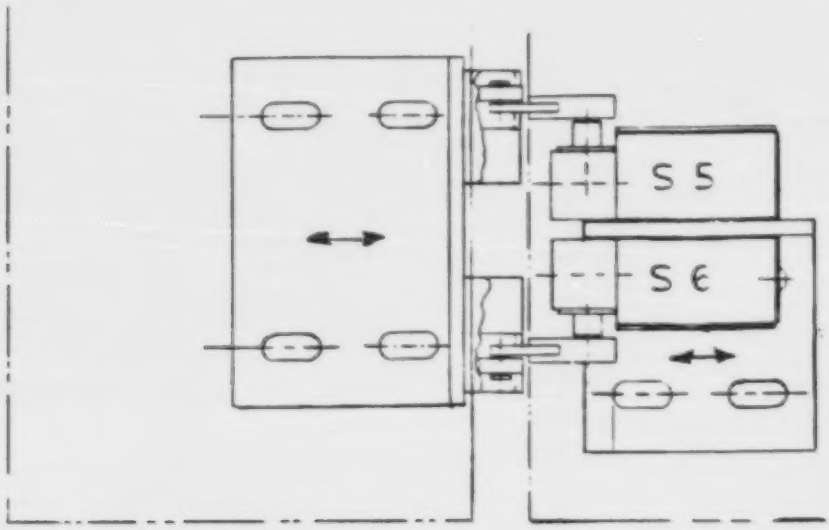


FIGURE 3: Installation des détecteurs de niveau.



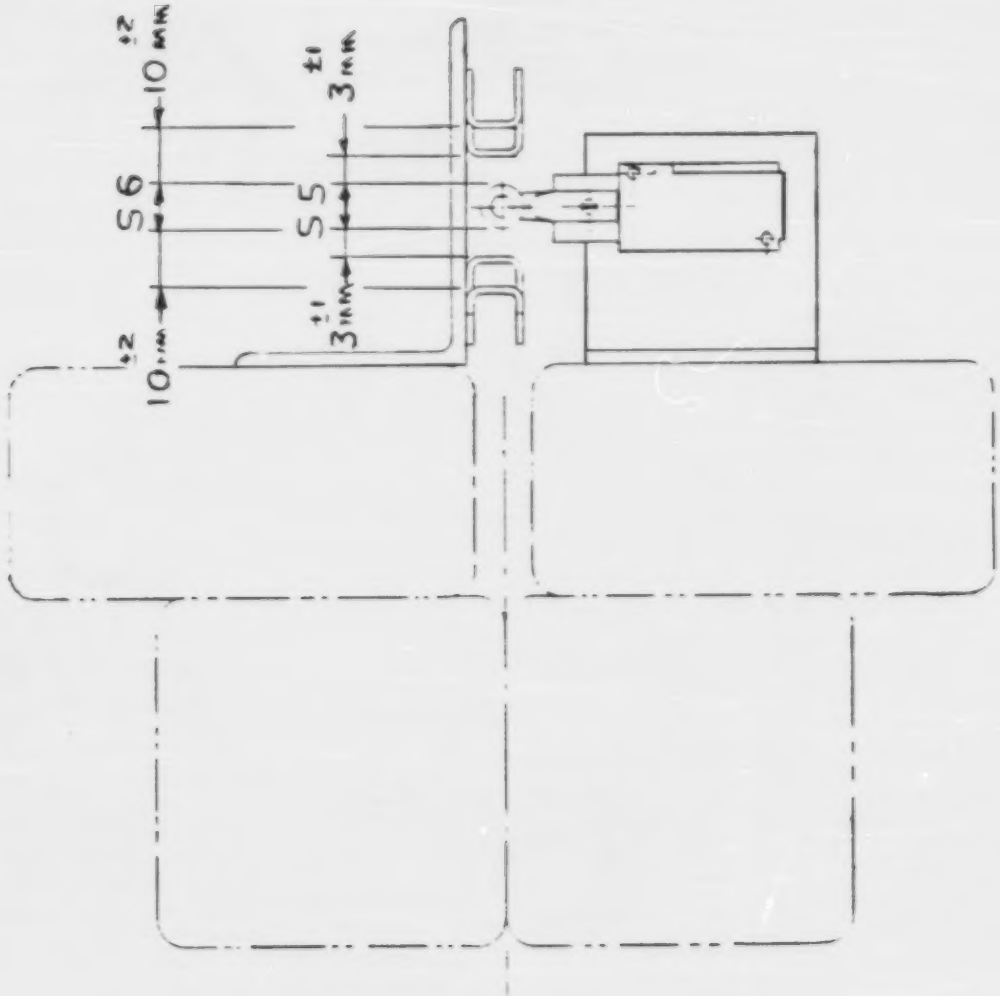


FIGURE 4: Installation des interrupteurs de synchronisation des plates-formes.

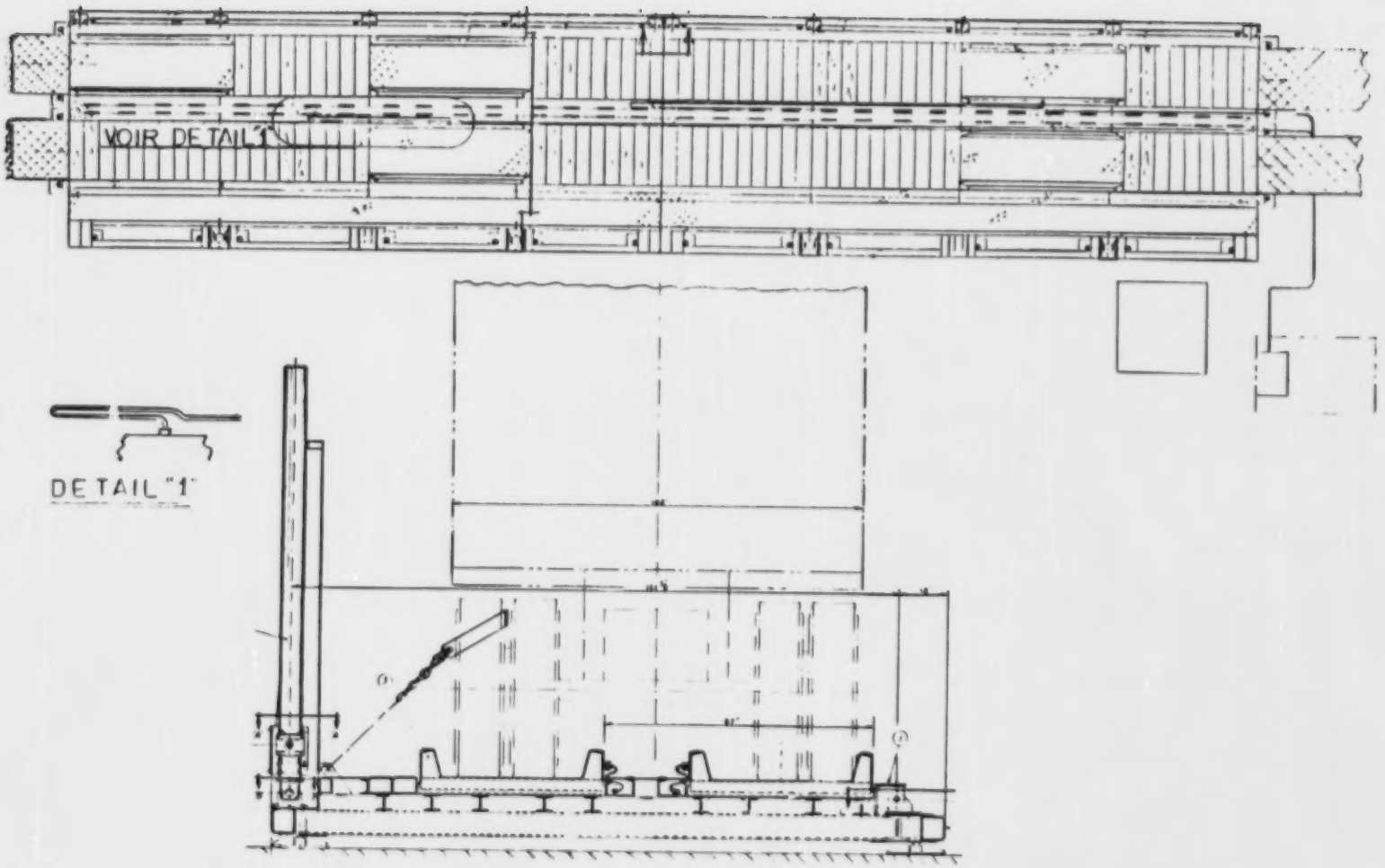


FIGURE 5: Installation des plateaux de pesage.

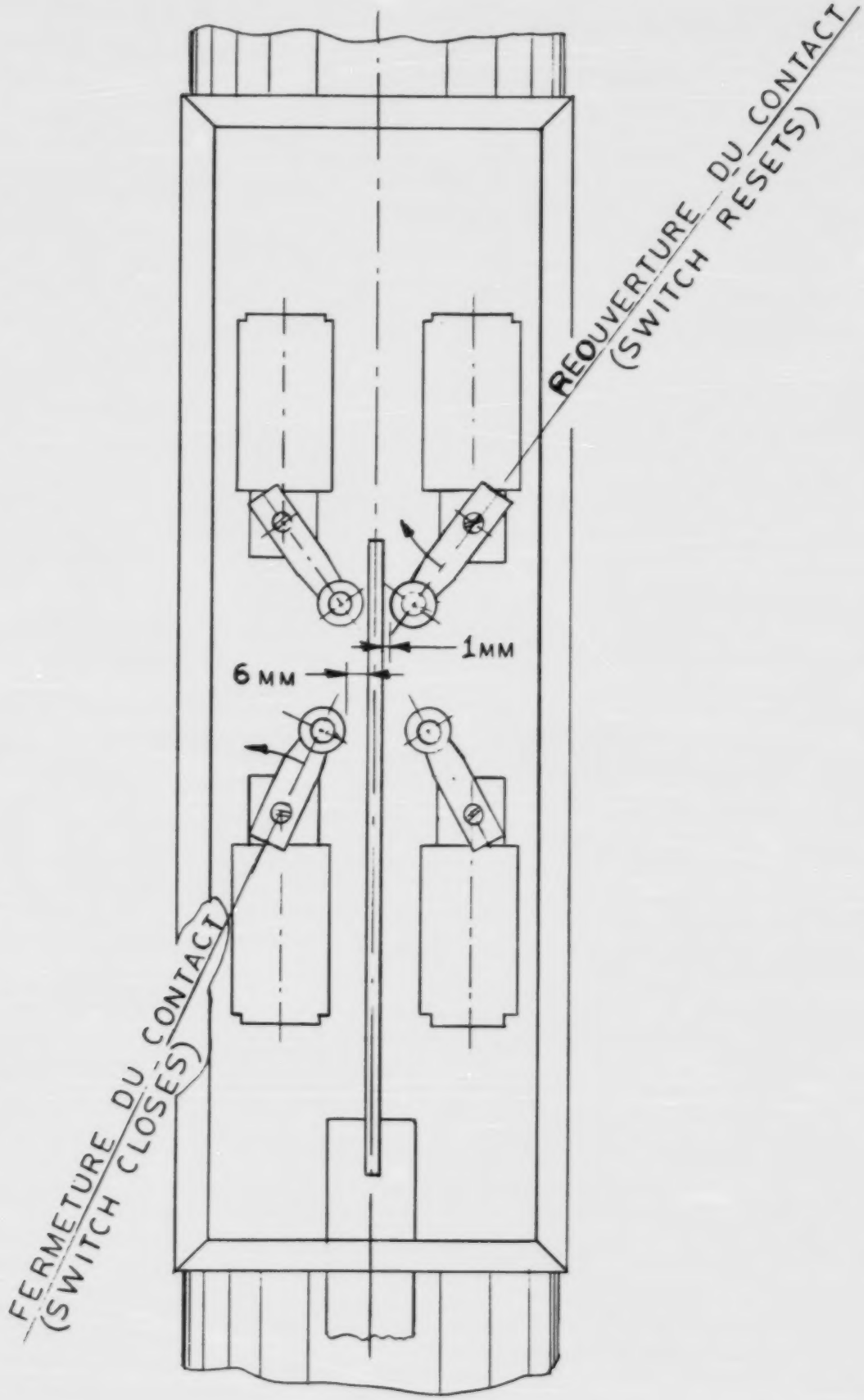


FIGURE 6: Ajustement des interrupteurs de contrôle du niveau.

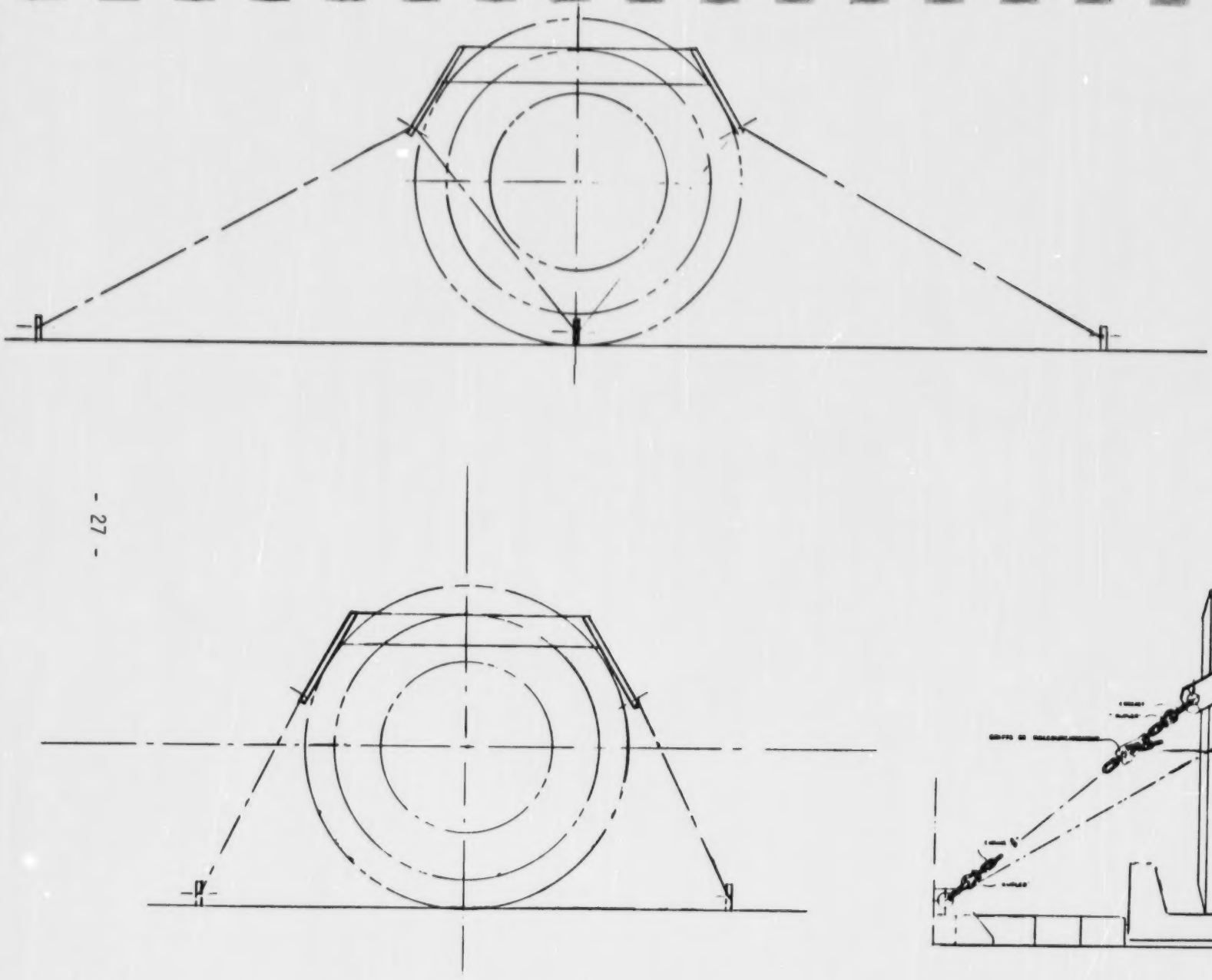


FIGURE 7: Installation des attaches aux roues.

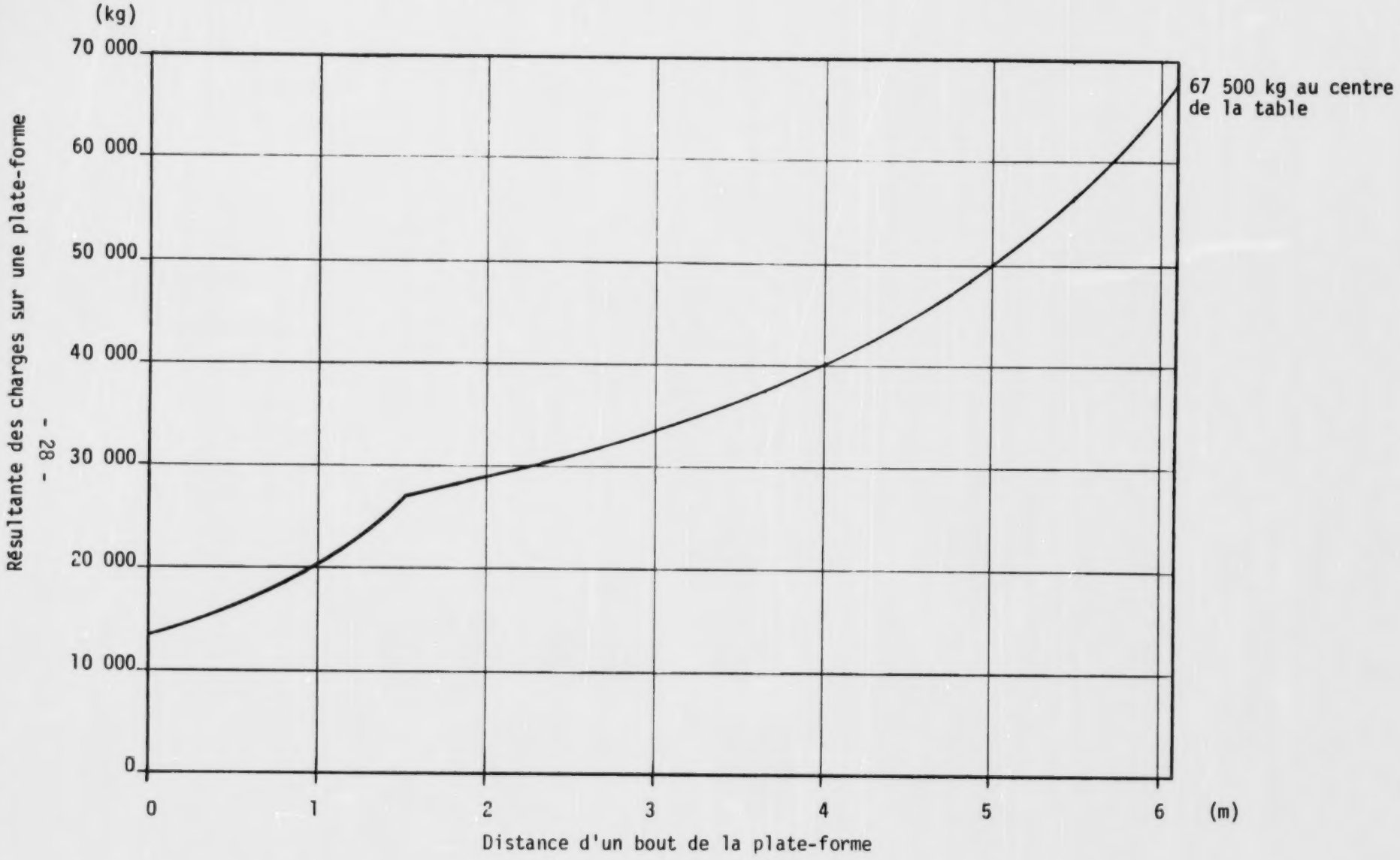


FIGURE 8: Résultante maximale des charges sur une plate-forme en fonction de la position.

ANNEXE A

Système hydraulique

- Schéma de principe
- Liste des pièces
- Spécifications

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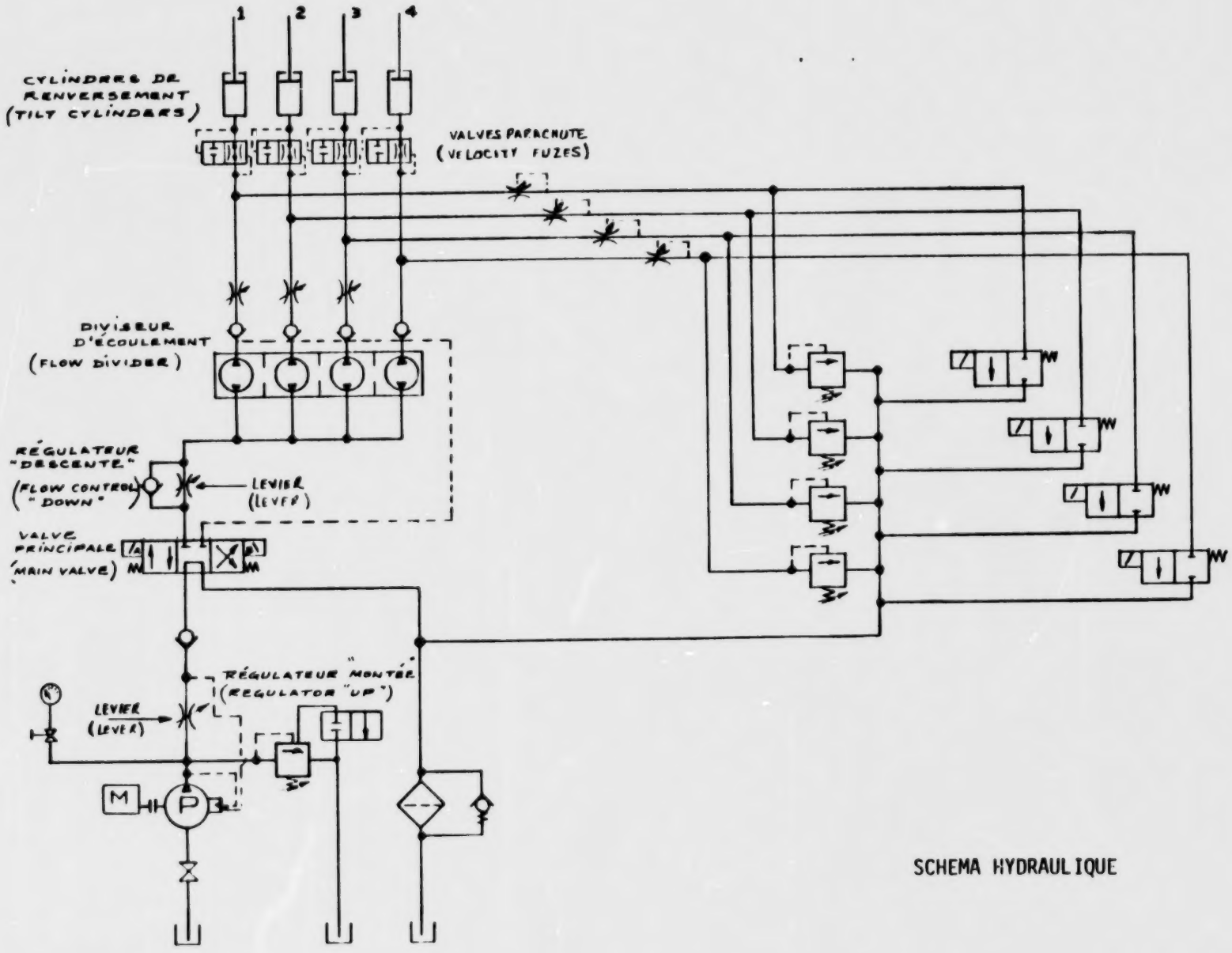

SCHEMA HYDRAULIQUE

LES ENTREPRISES SHP LTÉE

NOMENCLATURE

SHP 16197 F

MACHINE Table de Renversement DATE April 15/85 PAR

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QTÉ 1 TITRE Groupe Hydraulique DESSIN B-9171

PROJET 5878

ITEM	QTÉ.	DESCRIPTION	√	MARQUE	P.O.	RECEP. PRÉVUE		
	1	Réservoir 350 l avec base moteur Diesel et réservoir pour caburant Diesel		REXROTH	12154			
	1	152114 Porte de visite		REXROTH	"			
	1	70-105 Valve de vidange		APOLLO	"			
	1	ELF3-10/1.0 Reniflard		HYCON	"			
	1	FSA127-1.0/T Indicateur de niveau		HYCON	"			
	1	RFBN240G10B1.1/5 Filtre de retour		HYCON	"			
	1	2222-BL Valve d'isolement aspiration		JENKINS	"			
	1	1.767.379 Manomètre 0-3000 PSI		V.D.O.	"			
	1	DV8-1.0/5PS Valve d'isolement		HYCON	"			
	1	A10V63DR1R14 Pompe à pistons		REXROTH	12153			
	1	2722E Moteur Diesel 61/72HP-22T/MN		FORD	12162			
	1	DP01-3-11C2 Boite d'entrainement		MARCO	12163			
	1	1AR13-F6-40S Valve de sécurité		FLUID CONTROLS	12308			
	1	KHB10(3/8")-1-1-1-2 Valve boisseau sphérique		HYCON	STK			
	1	S310MC1968 Bloc contrôle de vitesse et de charge avec :		SHP	12139			
	1	2F76-L6-6-25S Contrôle de débit		FLUID CONTROLS	STK			
	1	RV20-1.0/5 Clapet anti-retour		HYCON	12313			

ITEM	QTE.	DESCRIPTION	✓	MARQUE	P.O.	RECEP. PRÉVUE		
	1	G172/5 Embase		REXROTH	12153			
	1	S310MC9169 Bloc régulation de descente avec :		SHP	12139			
	1	2F76-L6-6-25S Contrôle de débit		FLUID CONTROLS	STK			
	1	3C90-SV Clapet anti-retour		FLUID CONTROLS	STK			
	1	M3XX2012-A-2012-A-2012XXX Diviseur de débit		HPI	12141			
	1	S310MC9170 Bloc de contrôle égalisation		SHP	12139			
	4	1A20-F-40S Valve de sécurité		FLUID CONTROLS	12148			
	4	7W90-2-12S Distributeur électro-magnetique 2/2		FLUID CONTROLS	12148			
	1	4WEH16E5X/AG12NETD/5 Valve de distribution		REXROTH	12153			

LES ENTREPRISES SHP LTÉE

NOMENCLATURE

SHP 16197 F

MACHINE Table de Renversement

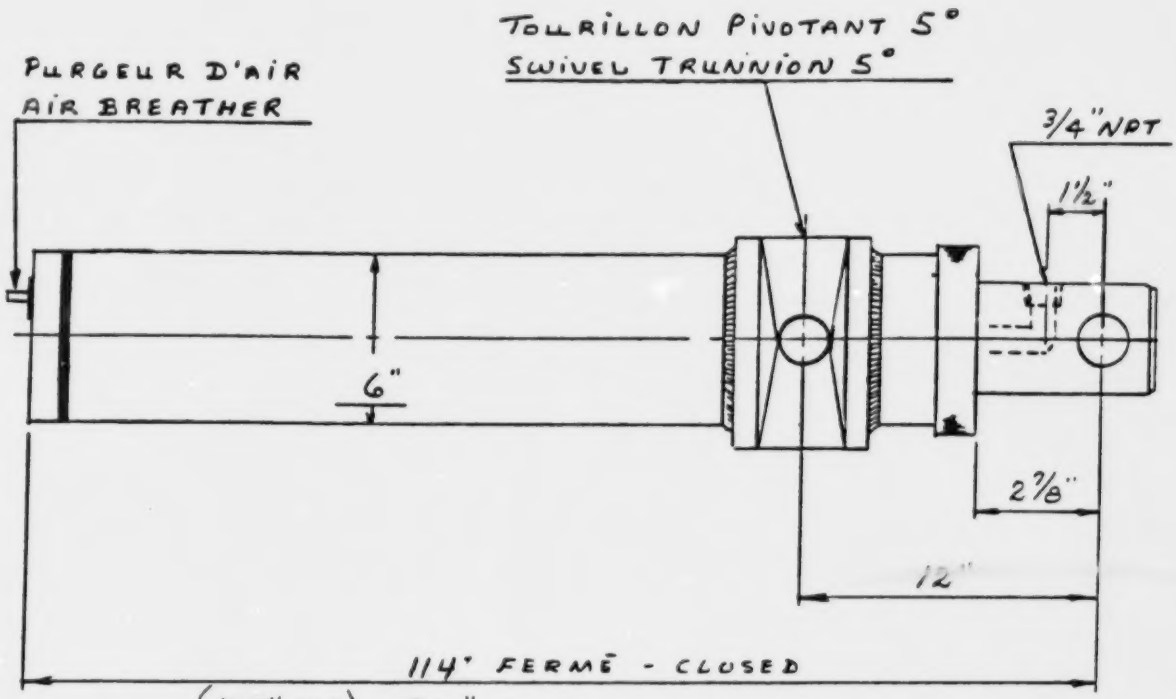
DATE April 15/85 PAR

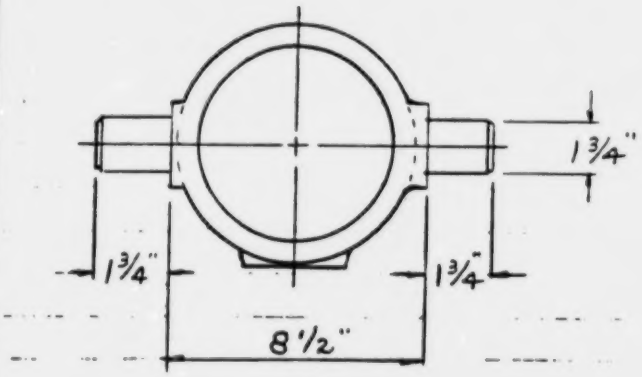
QTÉ TITRE Matériel Auxiliaire

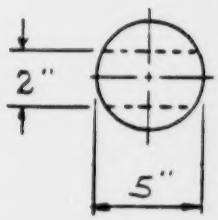
DESSIN B-9171

PROJET 5878

ITEM	QTÉ.	DESCRIPTION	√	MARQUE	P.O.	RECEP. PRÉVUE		
	4	Vérin simple effet. 5" alésage x 93" course		LESSARD	PAR CLIENT			
	4	28001-506-8 Valve parachute		VAN BERG	12155			
	2	MA-300137 Station de commande		MORSE	12232			
	2	38012-003-0240-20" Cables flexibles avec attaches		MORSE	12232			







POIDS (WEIGHT)
~145 kg (320 lbs)

VÉRIN SIMPLE ACTION SINGLE ACTING CYL.	5" ϕ
PRESSION MAX. OPERATION MAXIMUM WORKING PRESSURE	2,000 LBS PO/CA PSI

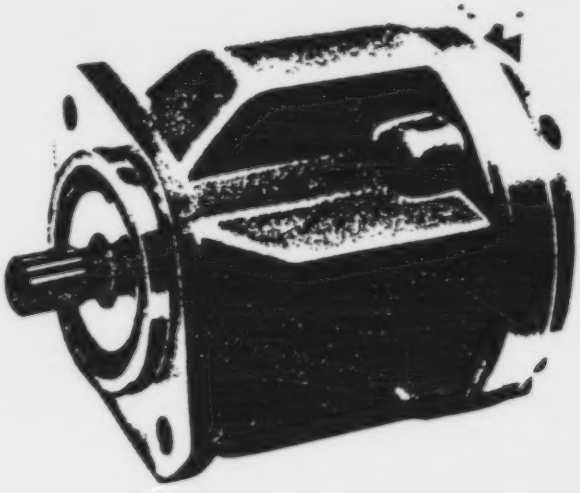
			C. P. 38 St Wenceslas, Co. Nicolet, Qué.	PAR RA	DATE 1 fév 85
				DESSIN No 85-104	REV
1	AFS	COURSE ÉTAIT 105"			

REXROTH
WORLDWIDE HYDRAULICS
MOBILE HYDRAULICS DIVISION
1700 Old Mansfield Rd.
P.O. Box 394 Wooster, OH 44691
216/262 2010 Telex: 98-6335
INDUSTRIAL HYDRAULICS DIVISION
2315 City Line Rd.
P.O. Box 2407 Bethlehem, Pa. 18018
215/694-8300 Telex: 84-7496

VARIABLE DISPLACEMENT PUMP, TYPE A10V
Mobile Design For Open Circuits
Axial Piston, Swashplate Design

RA 92700

Sizes 25 to 63	Up to 3600 psi	1.52 to 3.84 in³/rev.	Issue Date: 6/83



Description

The A10V is a swashplate design, variable displacement pump designed for open circuit, medium pressure applications. The flow output is proportional to the drive speed and swashplate angle.

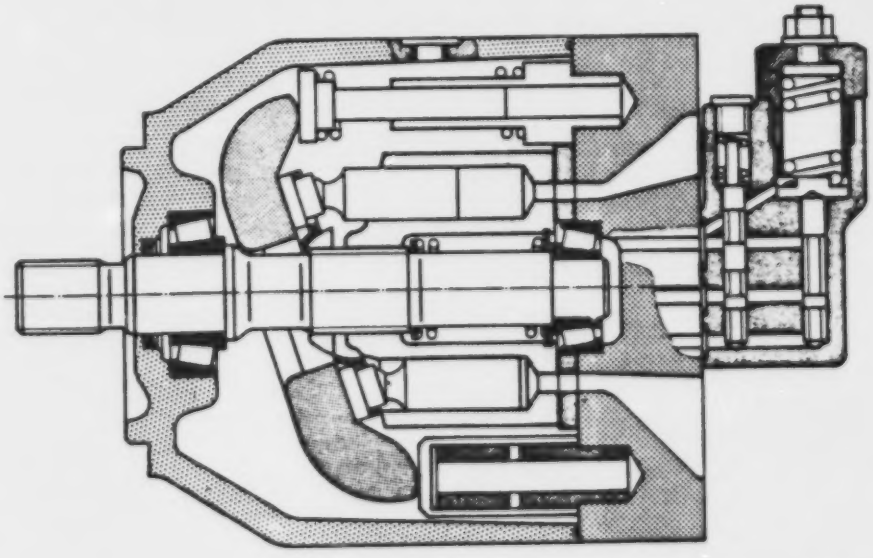
The A10V is available with controls for open circuit applications with closed-center valves.

Pressure compensator
Pressure & flow compensator (load sensing)
Constant HP Control

Features

- 2-bolt mounting flange and splined shaft to SAE J744
- SAE flange port connections with UNC bolt holes
- good suction characteristics
- peak pressure 3600 psi
- low noise level
- long service life
- axial and radial loading of drive shaft is permitted
- high power/weight ratio
- aluminum housing
- fast response times
- operation with mineral oil
- through drive for combination pumps

Construction



TYPE CODE

A10V	40	DFR	1	R	1	2 / –

Model

Variable displacement piston pump for open circuit applications, mobile design — A10V

Size

in³/rev.	(cm³/rev.)	
1.52	(25)	25
2.44	(40)	40
3.85	(63)	63

Controls

Pressure compensator — DR

Flow & pressure compensator (load sensing) — DFR

Constant HP-control (in preparation) — LR

Design Series No.

Series — 1

Direction of Rotation

As viewed at shaft end

Clockwise — R

Counter-clockwise — L

Mount And Drive Shaft Configurations

SAE 2-bolt flange and SAE splined shaft — 1

Port Configurations

SAE 4-bolt flange, rear facing — 2

SAE 4-bolt flange, side facing — 4

SAE 4-bolt flange, side facing with through drive — 6

Additional Information

in clear text

Type Code Example
A10V40DFR1R12
Variable displacement pump, type A10V, size 40, with flow and pressure compensator control, design series 1, clockwise rotation, S.A.E. splined shaft, S.A.E. 4-bolt flange, rear facing.

Mounting Position
Optional, ensure that pump housing is always filled with the fluid used in the system.

Installation
The A10V may be face mounted to a drive gearbox or P.T.O. for mobile applications, or to standard foot mounting brackets.
The case drain line should be connected to the case drain port L, and run back to the reservoir in such a manner that the pump case always remains full of fluid.

Filtration
A return line filter having an element with a nominal rating of 10 microns or less is recommended. The reservoir and reservoir accessories should be designed to prevent ingression of contaminants into the reservoir.
If a suction filter is used, the nominal rating should also be 10 microns or less, and the filter should be sized so that a minimum inlet pressure of – 3 psig (0.8 bar absolute) or better is maintained.

Fluid Viscosity Ranges
The hydraulic fluid selected should operate within the following viscosity ranges.

Maximum viscosity at start-up	4600 SSU	(1000 mm²/s
Normal operating viscosity range	66-464 SSU	(12-100 mm²/sec)
Optimum viscosity range	81-141 SSU	(16-30 mm²/sec)
Minimum viscosity	60 SSU	(10 mm²/sec)

Fluid Temperature Range
– 13 °F to + 176 °F (– 25 ° to + 80 °C)
The fluid temperature level of a particular system is normally measured at the pump or motor case drain. This temperature is then used to establish the cooling requirements for the system.

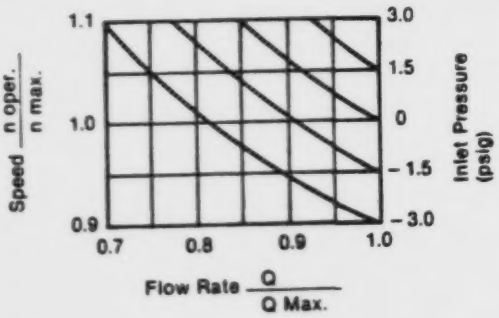
TECHNICAL DETAILS

GENERAL SPECIFICATIONS A10V PUMP				
Specification	**Unit**	**A10V25**	**A10V40**	**A10V63**
Displacement	in³/rev	1.52	2.44	3.84
	cm³/rev	25	40	63
Nominal flow at 1000 rpm	gpm	6.6	10.5	16.6
	l/min	25	40	63
Torque constant (theoretical)	lb ft/100 psi	2.01	3.23	5.09
	Nm/bar	0.39	0.64	1.00
Maximum drive speeds — Inlet pressure, – 3.0 psig	rpm	3000	2500	2200
Maximum drive speeds — Inlet pressure, 0 to 215 psig	rpm	3250	2800	2400
Rated pressure (continuous)	psi	3000	3000	3000
	bar	207	207	207
Peak pressure (intermittent)	psi	3625	3625	3625
	bar	250	250	250
Minimum Operating Pressure	psi	75	75	75
	bar	5	5	5
Minimum inlet pressure at suction port 'S'	psig	– 3.0	– 3.0	– 3.0
	bar	-0.8	0.8	0.8
Maximum inlet pressure at suction port 'S'	psig	215	215	215
	bar	15	15	15
Weight (dry)	lbs	24.2	33.0	55.0
	Kg	11.0	15.0	25.0
Filling capacity of pump case	in³	43	61	97
	liter	0.7	1.0	1.6
Maximum permissible external loading of the drive shaft	F_A lbs	225	337	540
	N	1000	1500	2400
	F_R lbs	540	810	1350
	N	2400	3600	6000

*The above specifications & performance details are assuming the use of a good quality petroleum based hydraulic fluid. Use of snythetic fluids and water/oil emulsions is possible with derated specifications and performance. Contact Rexroth for details.

Pump Drive Speed

The following chart details the maximum drive speed in relation to inlet pressure (at suction port "S") and pump output flow.



Maximum Allowable Case Pressure
(Measured at case drain port L) 7.25 psi (0.5 bar) above inlet pressure (at suction port "S") but not more than 29 psig (2 bar)

Start-Up

The pump case must be filled with the hydraulic fluid used in the system.

Before starting, allow the pump to discharge directly to the reservior (open center circuit) with lowest possible pressure drop.

Prior to running the pump at full speed, the drive should be jogged until fluid begins to flow from the line returning to the reservoir. With the circuit still in the "open center" mode, run the pump at design speed until a steady flow is obtained from the line returning to the reservoir. Remove the open center (short circuit) and operate the pump in the normal closed center mode.

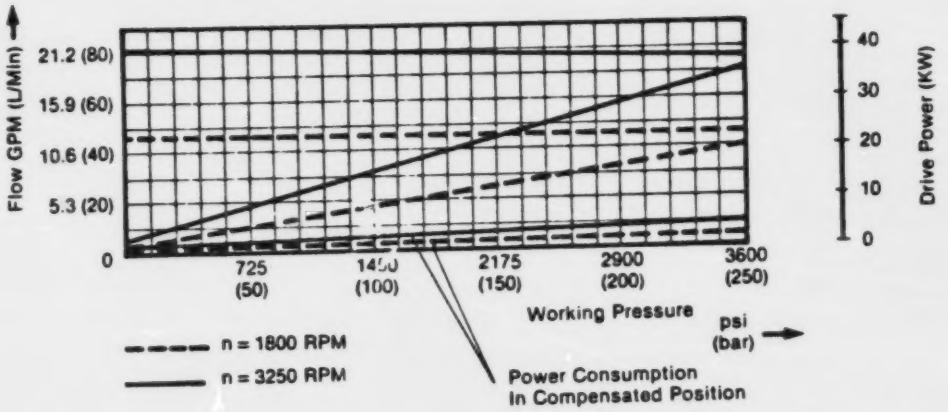
Some applications may require a slight departure from the above procedure.

REXROTH
WORLDWIDE HYDRAULICS

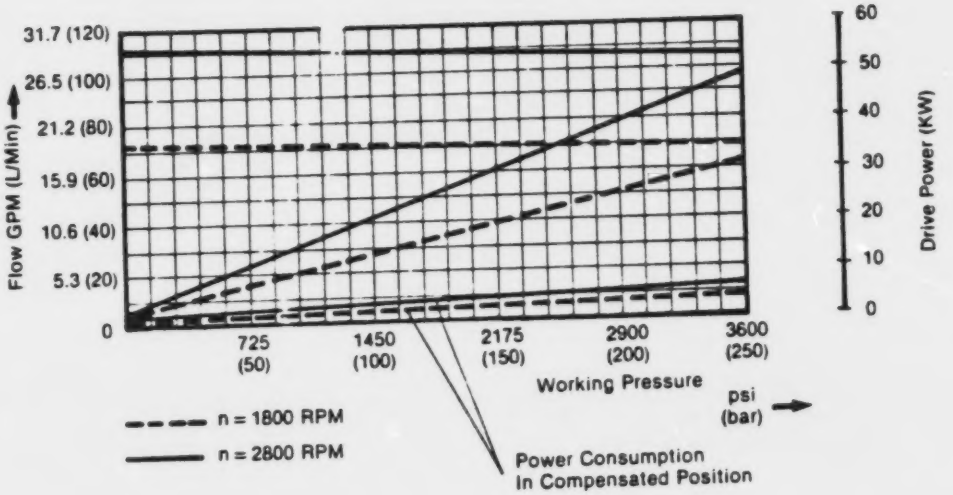
PERFORMANCE CHARACTERISITICS

(MINERAL OIL)
DRIVE POWER AND FLOW OUTPUT

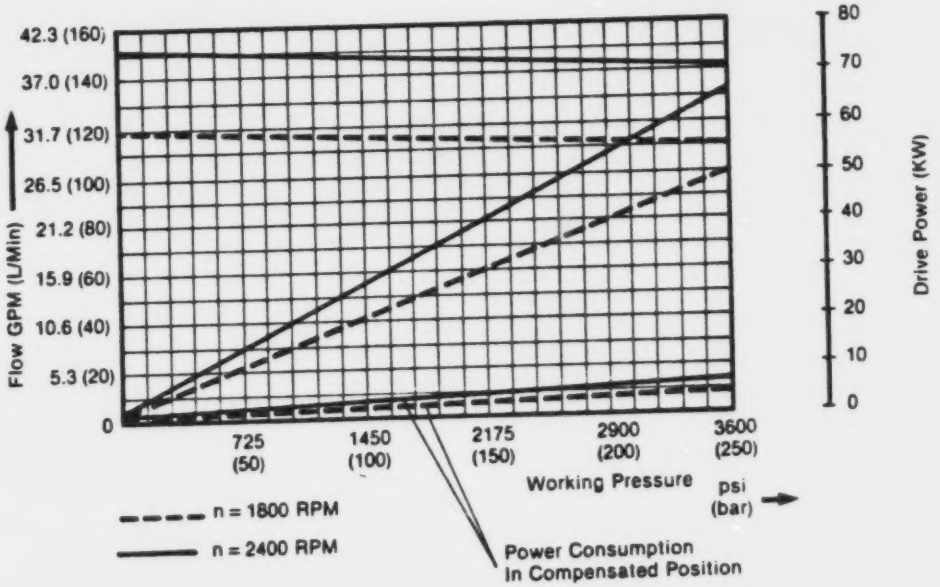
SIZE 25



SIZE 40



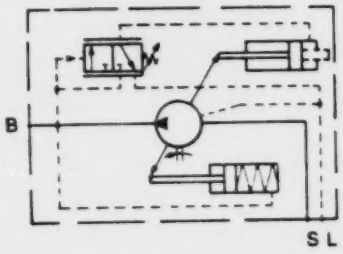
SIZE 63



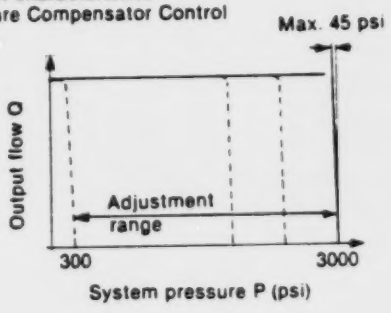
CONTROL DESCRIPTIONS (Description for Constant HP-Control in Preparation)

Pressure Compensator, Type DR

The pressure compensator control gives maximum output flow to the system until the system reaches the pre-adjusted pressure setting of the control. The pressure compensator control then regulates the pump output flow to equal the flow requirements of the system while maintaining the pre-adjusted output pressure. When the system no longer requires flow, the pressure compensator control will cause the pump to destroke so that there is no output flow while maintaining the pre-adjusted pressure.

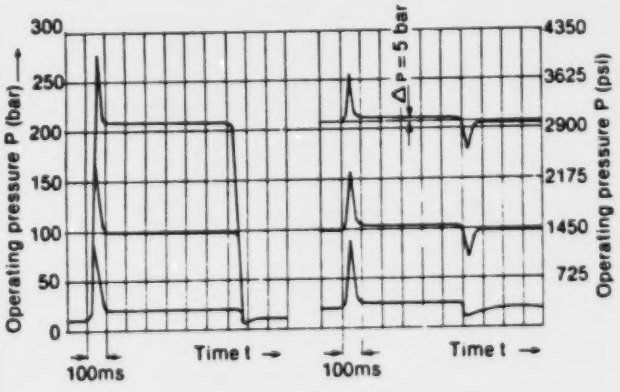


Control characteristics—
Pressure Compensator Control



Dynamic Characteristics
of the Pressure Compensator Control (DR)

measured with 2/2-way valve; without pressure relief valve (pipe between pump and valve 400 mm long, 20 mm dia.)

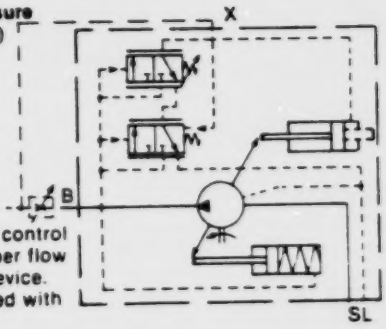


Flow & Pressure Compensator, Type DFR

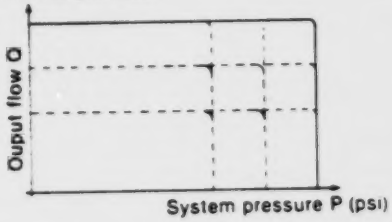
The flow and pressure compensator control, also known as a load-sensing control, matches pump output flow and pressure to system demand. This control will automatically regulate the pump displacement to deliver the flow required to maintain a constant pressure drop across a valve spool or other flow limiting device. When there is no system demand, the pump stands by at zero flow and low pressure. When the system demands flow, the pump delivers only the flow required by the system, at a pressure required to move the load.

To protect the system from infinite load pressures, the pressure compensator section of the control will cause the pump to automatically destroke when the pre-adjusted maximum system pressure is reached.

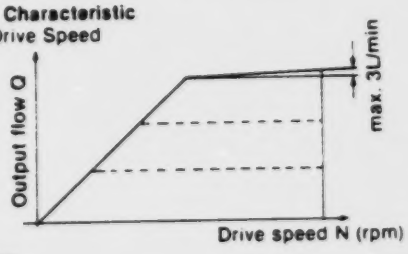
Stand-by Pressure
203 psi (14 bar)



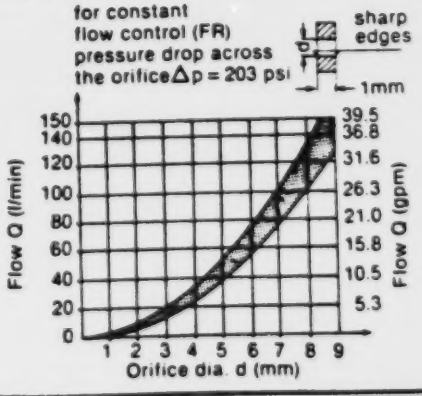
Control characteristics—
Flow and Pressure Compensator



Constant Flow Characteristic
with Variable Drive Speed



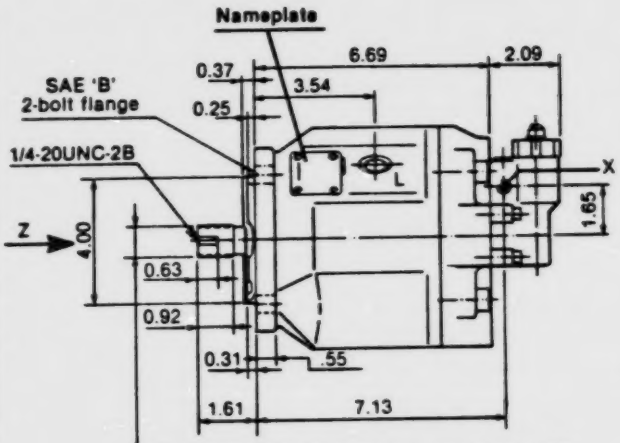
Orifice Selection



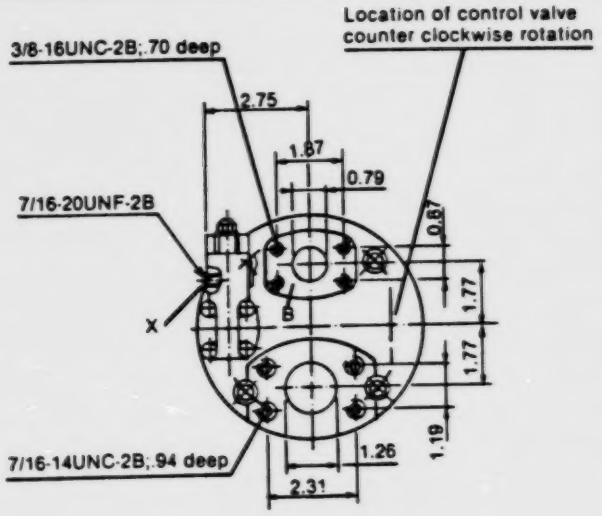
REXROTH WORLDWIDE HYDRAULICS

INSTALLATION DIMENSIONS A10V25

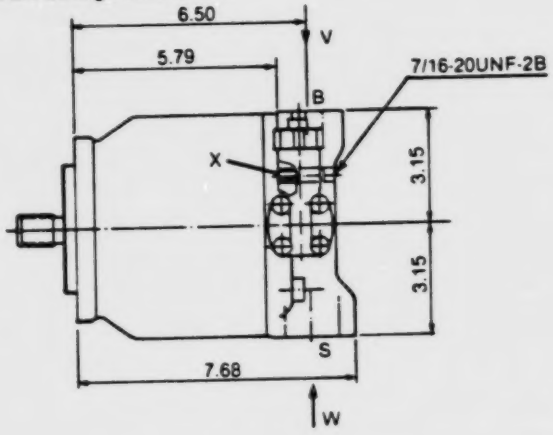
Direction of Rotation: Clockwise
Port Configuration No. 2

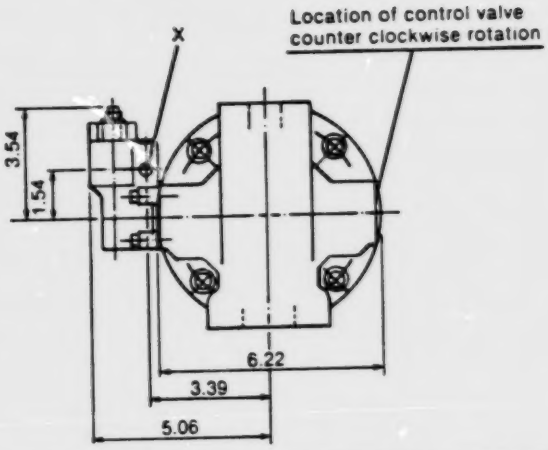


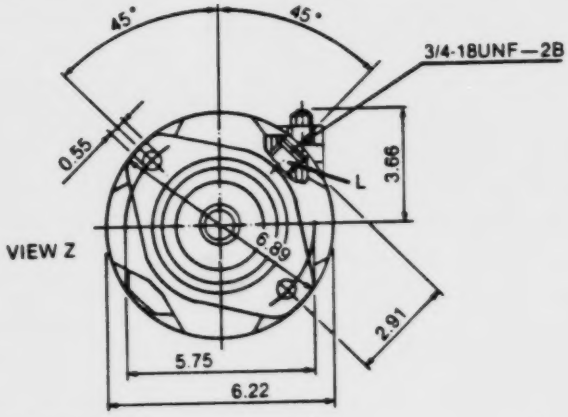
7/8 DIA. 13 TEETH, 16/32 D.P., 30° INVOLUTE,
FLAT ROOT, CLASS I SIDE FIT SPLINE (SAE J498b)

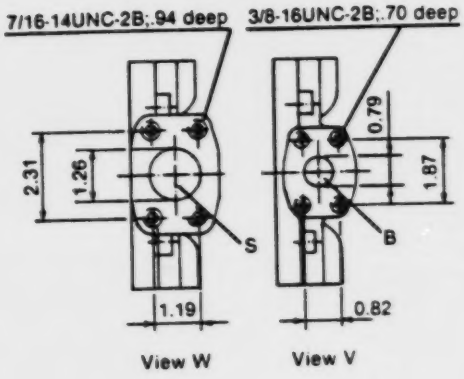


Port Configuration No. 4







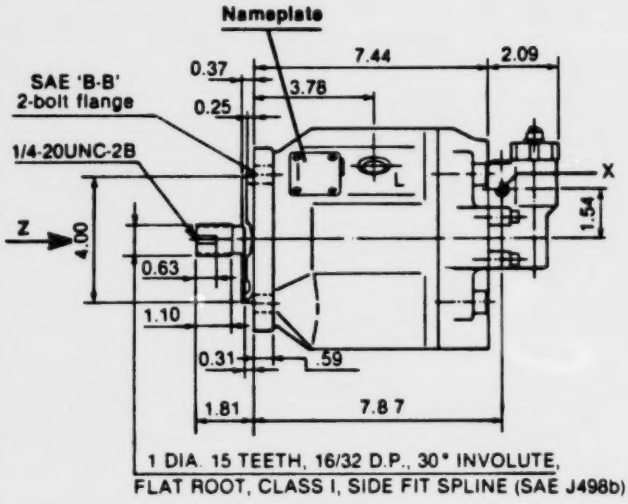


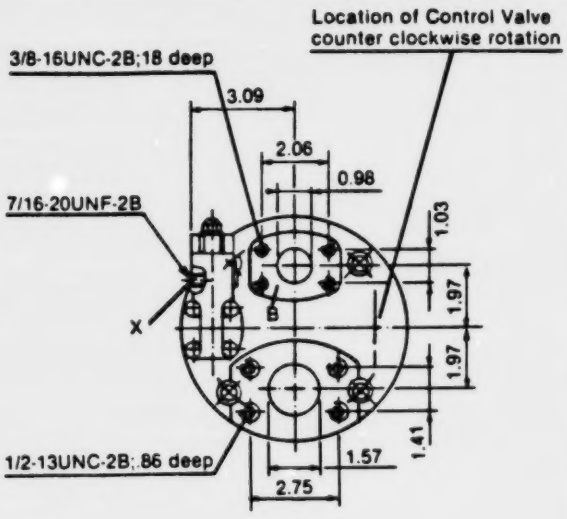
Port Connections

B = High Pressure Work Port SAE ¾" - 3000 psi
S = Suction Port SAE 1¼" - 3000 psi
X = Load Sensing Pilot Port
L = Case drain port

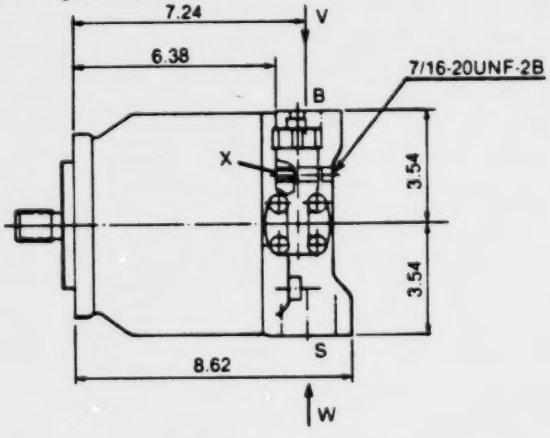
INSTALLATION DIMENSIONS A10V40

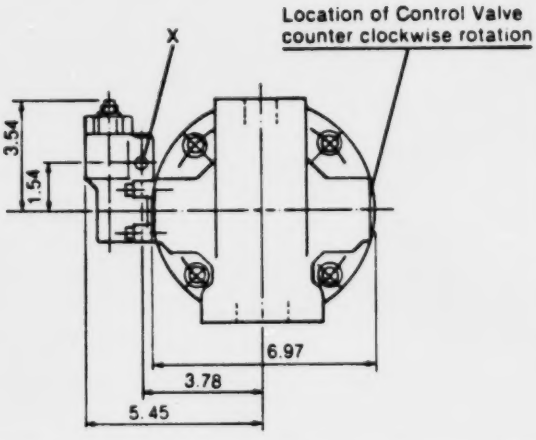
Direction of Rotation: Clockwise
Port Configuration No. 2

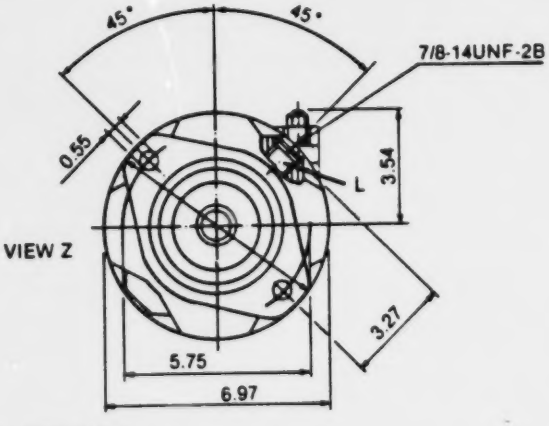


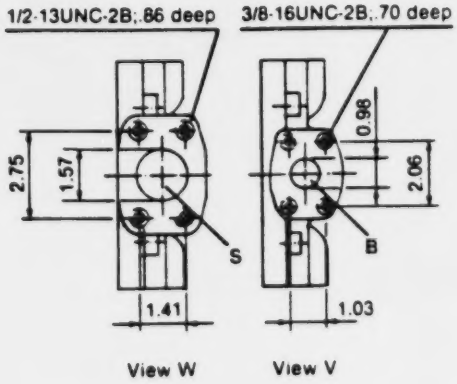


Port Configuration No. 4









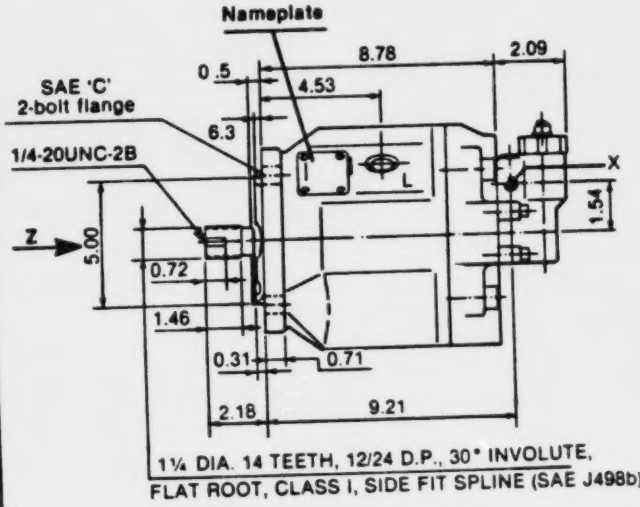
Port Connections

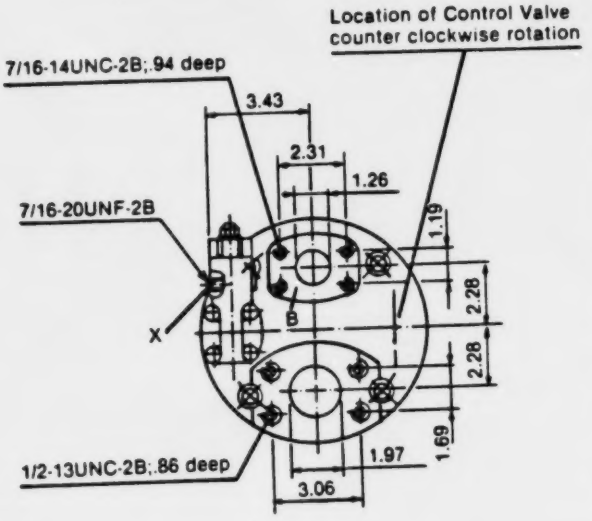
B = High Pressure Work Port SAE 1" - 3000 psi
S = Suction Port SAE 1½" - 3000 psi
X = Load Sensing Pilot Port
L = Case Drain Port

REXROTH
WORLDWIDE HYDRAULICS

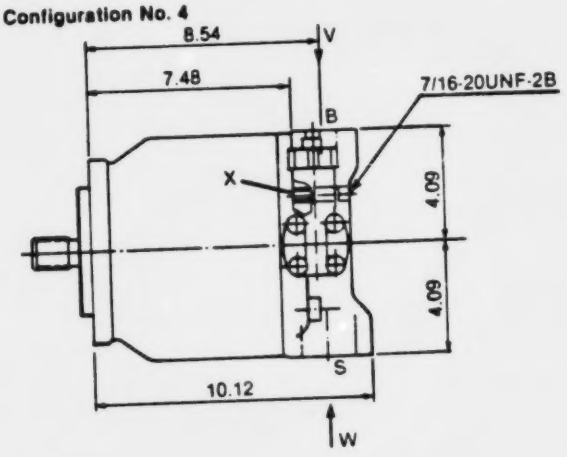
INSTALLATION DIMENSIONS A10V63

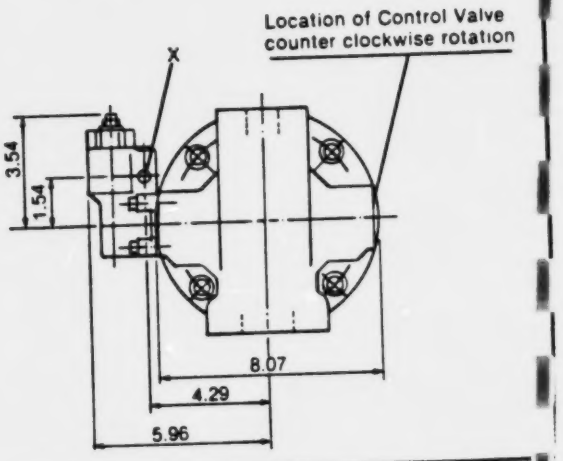
Direction of Rotation: Clockwise
Port Configuration No. 2

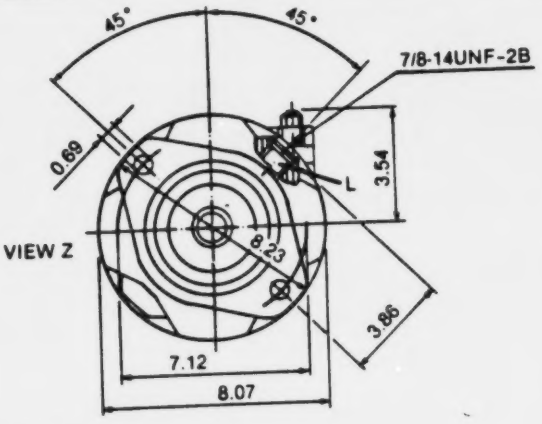


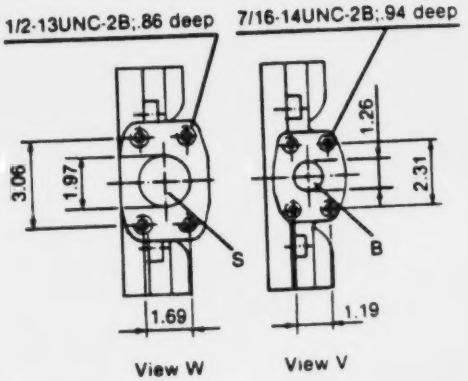


Port Configuration No. 4









Port Connections

B = High Pressure Work Port SAE 1¼" - 3000 psi
S = Suction Port SAE 2" - 3000 psi
X = Load Sensing Pilot Port
L = Case Drain Port

TANDEM PUMPS AND THROUGH DRIVES

Description

The A10V open circuit piston pumps can be combined to form tandem open circuit piston pumps, or a combination of open circuit piston pump plus a Rexroth S15S, S20S, or S30S gear pump.

Available Combinations

	Piston Pump			Gear Pumps*		
Basic Pump +	A10V25	A10V40	A10V63	S15S	S20S	S30S
A10V25	●			O	●	●
A10V40	●	●		O	●	●
A10V63	●	●	●	O	●	●

O SAE A 2-bolt through drive is in preparation.

* Refer to technical data sheets

RA 64756 (S15S) RA 64783 (SVP20)
RA 64774 (S20S) RA 64789 (S30S)

It is recommended not to stack more than three pumps in one combination, ie 2x A10V piston pumps plus 1x gear pump.

Type Codes

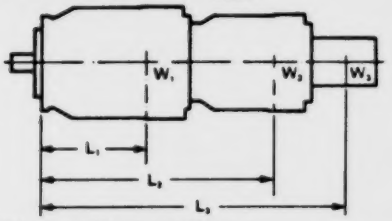
The type code for an A10V tandem or A10V + gear combination pump is derived by listing the type code of the basic pump (with number 6 port plate), a plus symbol (+), and the type code of the second piston or gear pump.

Example: A10V63DR1R16 + A10V40DR1R14

If only a through drive is required on an A10V piston pump (no second pump), the type code of the A10V is listed with the through drive size given in clear text.

Example: A10V63DR1R16/SAE B-B

Allowable Moment of Force (M_{max})



$M_{max} = (W_1 \times L_1) + (W_2 \times L_2) + (W_3 \times L_3)$

SIZE			25	40	63
Allowable Moment of Force	M_{max}	lb-ft	65	101	159
		kgm	9	14	22
Weight	W_1	lb	24.2	33.0	55.0
		kg	11	15	25
Distance to center of gravity	L_1	in	4.33	5.12	5.91
		mm	110	130	150

For weights of S15, S20 & S30 gear pumps, see relevant RA data sheet.

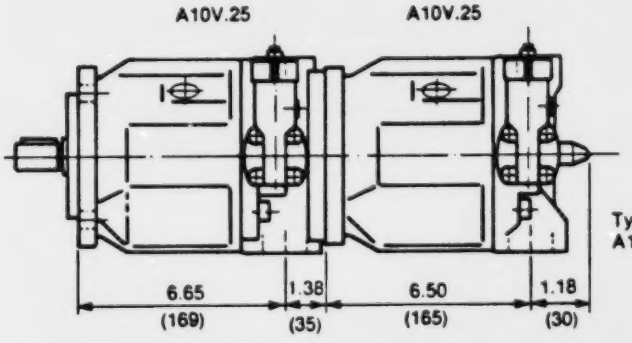
Allowable Through-Drive Torque

Size			25	40	63
Maximum allowable through-drive torque	T	lb-ft	66.5	103	166
		Nm	90	140	225

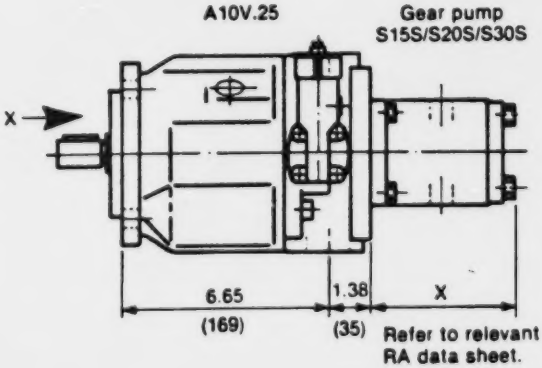
Note: For three pump combinations, the total torque requirement of the second and third pumps must not exceed the maximum permissible through-drive torque of the basic A10V piston pump.

Installation Dimensions

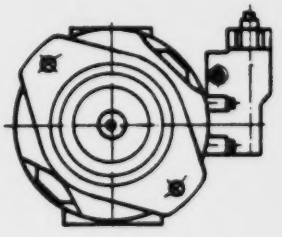
Tandem & Combination pumps with A10V25 basic pump.



Type code
A10V.25. .1. .1.6 + A10V.25. .1. .1..



Refer to relevant RA data sheet.



View X

Type code
A10V.25. .1. .1.6 + S15S

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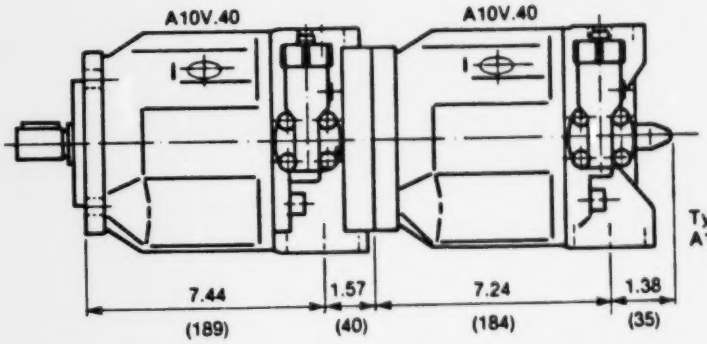
Installation Dimensions

Tandem & combination pumps with A10V40 basic pump.



Type code
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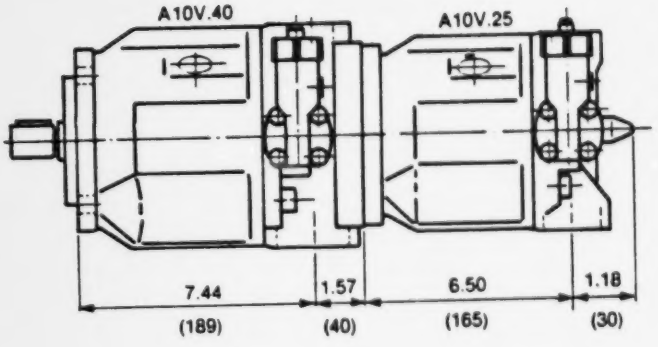

Type code
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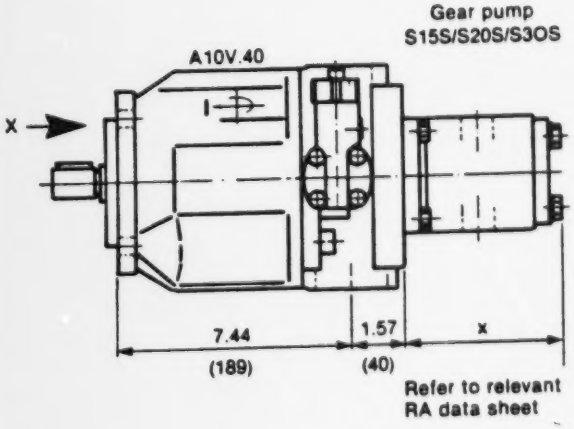
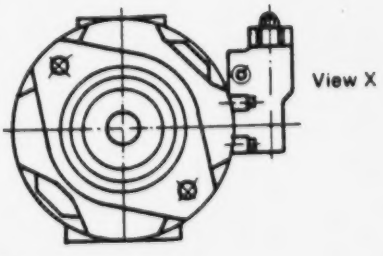
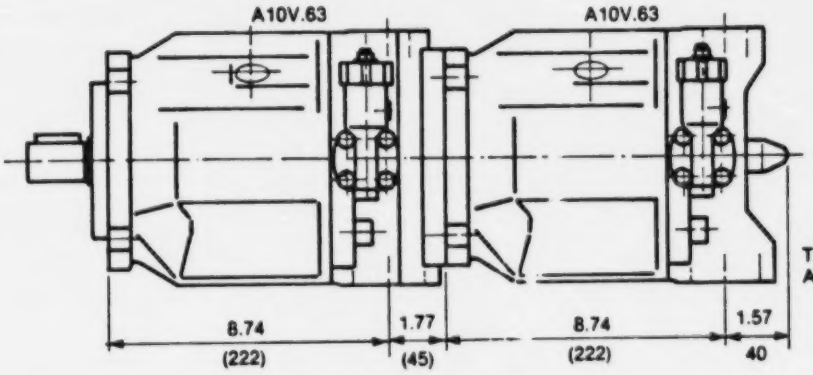




Type code
A10V.40. .1. .1.6 + S15S

Installation Dimensions

Tandem & combination pumps with A10V63 basic pump



Type code
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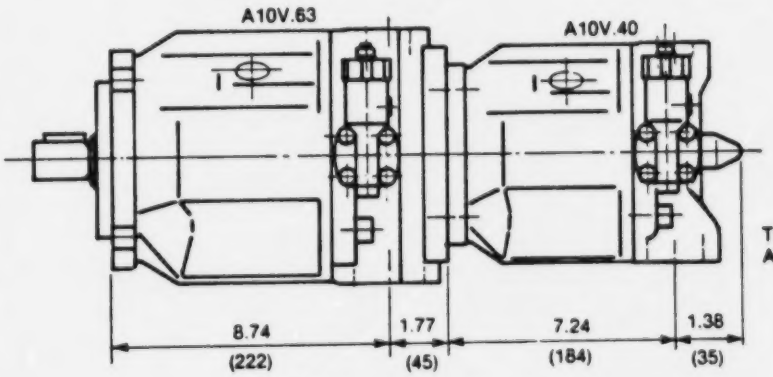

Type code
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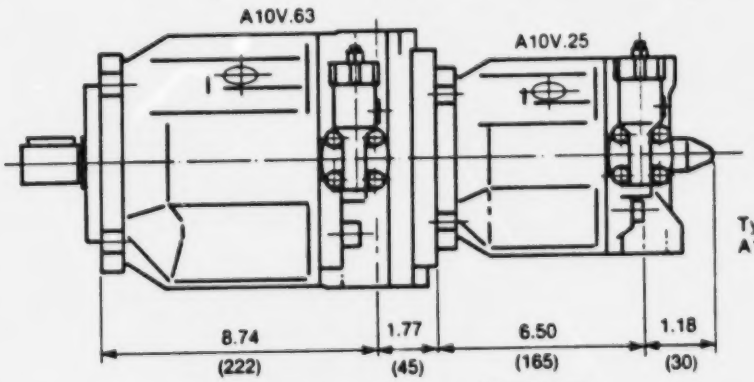

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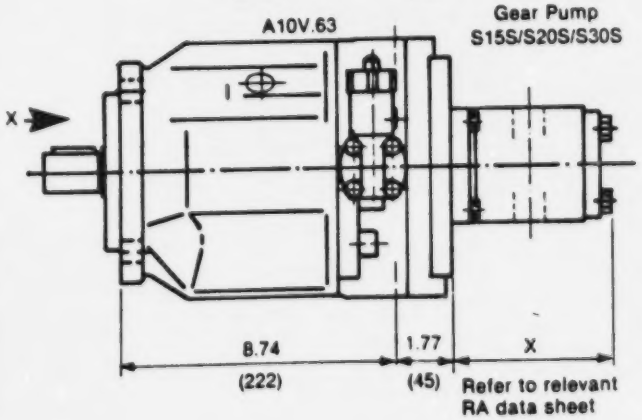
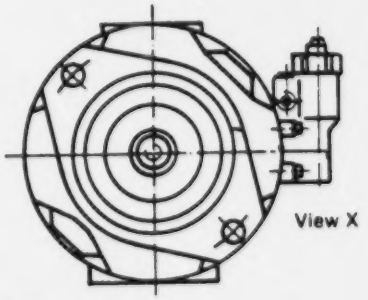


Gear Pump
S15S/S20S/S30S

Refer to relevant
RA data sheet



Type code
A10V.63. .1. .1.6 + S20S

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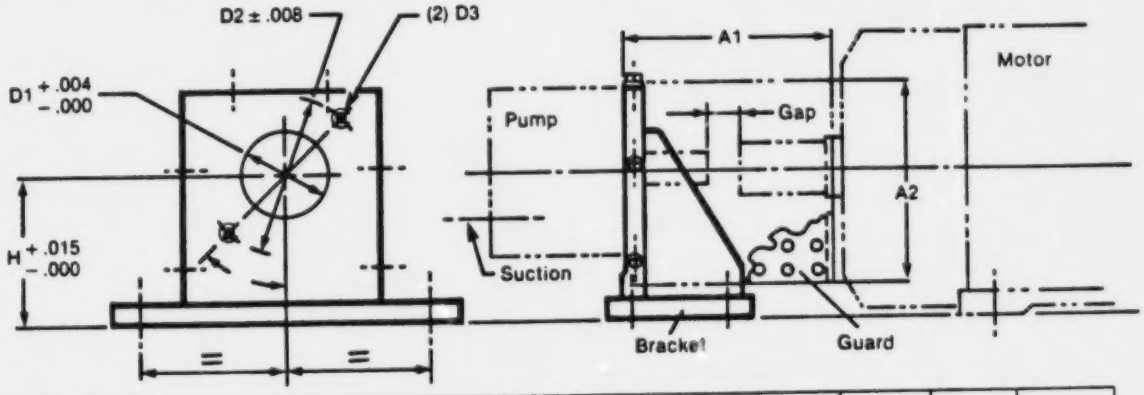
PUMP BRACKET AND GUARDS FOR A10V



Pump A10V	Motor Frame	Bracket Part No.	Design No. Pg. 1	H	D1	D2	D3	Guard Part No.	A1	A2	Gap
25 or 40	213T-215T	P810 938	2	5.25	4.004	5.750	1/2-13NC	P810 935	6.25	7.62	.85
	254T-256T	P810 939		6.25				P810 486	7.50	10.38	1.10
	284T-286T	P810 940		7.00				P810 487	8.12		
	324T-326T	P810 941	3	8.00				P810 936	8.75		1.25
63	284T-286T	P810 942	3	7.00	5.004	7.125	5/8-11NC	P810 487	8.12	10.38	
	324T-326T	P810 943		8.00				P810 936	8.75		1.25
	364TS-365TS	P810 944	4	9.00				P810 937	7.50	12.44	
	364T-365T							P810 492	9.38		1.44

REXROTH
WORLDWIDE HYDRAULICS

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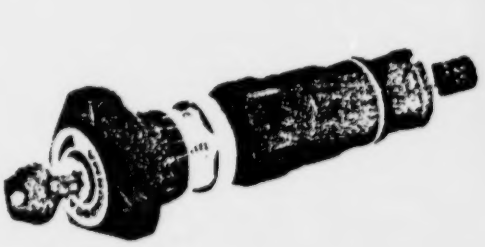
Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing. Rexroth reserves the right to discontinue models or options at any time or to change specifications, materials, or designs without notice and without incurring obligations.

Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options. For the available combinations refer to the relevant data sheets for the basic unit and the desired option.

Information contained herein should be confirmed before placing orders.

MANNESMANN REXROTH	Direct Operating Pressure Relief Valve Type DBD / Series 10			RE 25 402/9.84 Replaces: 3.83 and RE 25 403
	Sizes 6 to 30	up to 630 bar	up to 330 L/min	

- as cartridge valve
- for threaded connections
- for subplate mounting
- 3 optional pressure setting elements:
  setting screw with protective cap
  handknob/handwheel
  lockable handknob

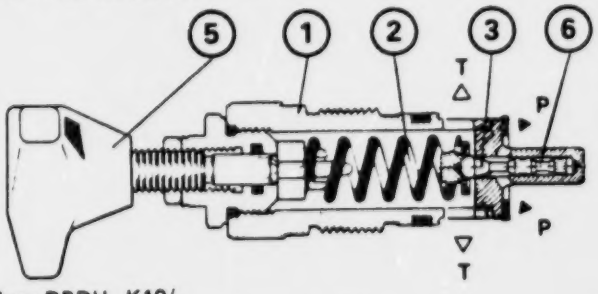


Typ DBDA..K10/..

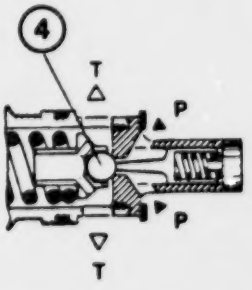
Description of Function, Section

Pressure relief valves type DBD are direct operated poppet valves.
They serve to limit pressure in a system.
The valves consist basically of a sleeve (1), spring (2), poppet with damping spool (3) (up to 400 bar) or ball (4) (630 bar) and the pressure setting element (5), by means of which system pressure is steplessly set. Spring (2) presses poppet (3) on to its seat. The P-line is connected to the system. Pressure in the system acts on the face of the poppet (or ball).

If pressure in the P-line increases beyond the value set at spring (2), poppet (3) opens against spring (2). Oil now flows from the P-line into the T-line. The stroke of the poppet is limited by a pin.
In order to obtain accurate pressure setting over the complete pressure range, the pressure range has been divided into 7 pressure ratings, each corresponding to a specific spring with a relevant maximum pressure setting.



Type DBDH..K10/...
Model for up to 400 bar (poppet valve)

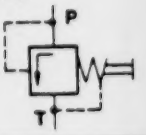


630 bar model (ball valve)

Symbols

simplified

detailed



Ordering Code

DBD | | | | 10 / | | | *

Further details in clear text

Setting screw with protective cap = S
Handknob (up to size 20) = H
handwheel (sizes 25 and 30)
Lockable handknob (up to size 10) = A

no code = Suitable for: mineral oil to DIN 51524 and 51525 (H-L, H-LP)
V = phosphate-ester (HF-D)

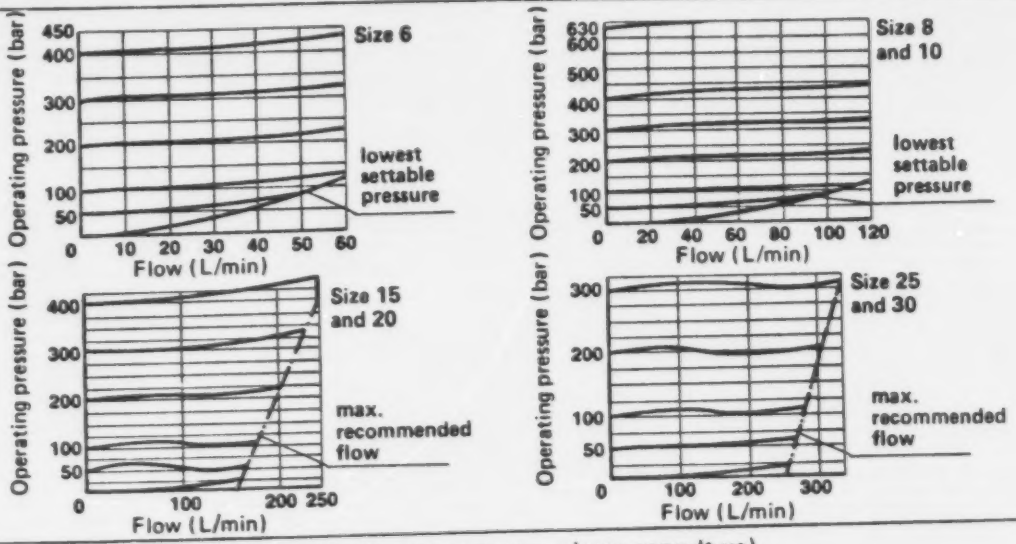
Type of connection		G	K	P
Size 6 (1/4" BSP)	=	6	6	6
Size 8 (3/8" BSP)	=	8	–	–
Size 10 (1/2" BSP)	=	10	10	10
Size 15 (3/4" BSP)	=	15	–	–
Size 20 (1" BSP)	=	20	20	20
Size 25 (1 1/4" BSP)	=	25	–	–
Size 30 (1 1/2" BSP)	=	30	30	30

Cartridge valve = K
Threaded connections = G
Subplate mounting = P

Size 10	Size 6 to 20	Size 25 and 30
Ordering Code		
25 = 25 bar	25 = 25 bar	25 = 25 bar
50 = 50 bar	50 = 50 bar	50 = 50 bar
100 = 100 bar	100 = 100 bar	100 = 100 bar
200 = 200 bar	200 = 200 bar	200 = 200 bar
315 = 315 bar	315 = 315 bar	315 = 315 bar
400 = 400 bar	400 = 400 bar	–
630 = 630 bar	–	–

10 = Series 10 (10 to 19 ② install. and connection dimens. remain unchanged)

Operating Curves (measured at ν = 36 mm²/s and t = 50°C)

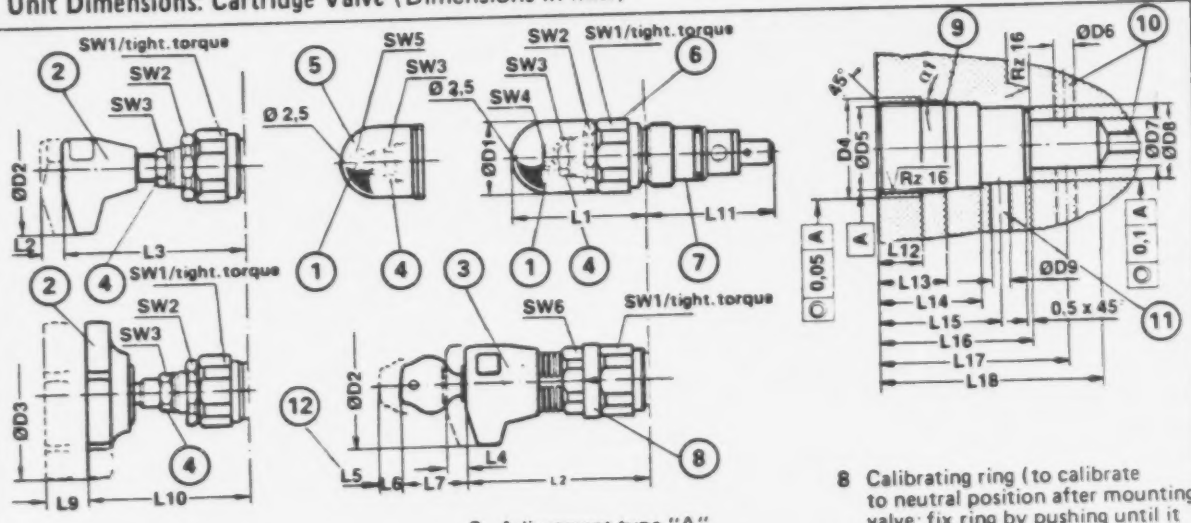


Technical Data (For applications outside these parameters, please consult us)

Hydraulic fluid:
Mineral oil to DIN 51524 and 51525 (H-L, H-LP);
Phosphate-ester (HF-D)
Fluid temperature range: – 20 to + 70°C
Viscosity range: 2.8 to 380 mm²/s

Operating pressure range		Size 10	Sizes 6 to 20	Sizes 25 and 30
– inlet side	(bar)	up to 630	up to 400	up to 315
– outlet side	(bar)	up to 315		

Unit Dimensions: Cartridge Valve (Dimensions in mm)



1 Adjustment type "S"
Setting screw for pressure setting;
internal hexagon (up to size 20)
external hexagon (size 30)

2 Adjustment type "H"
handknob for press. setting (up to size 20)
handwheel for pressure setting (size 30)

3 Adjustment type "A"
handknob with lock for pressure setting (up to size 10)

4 Locknut

5 Protective cap

6 Type code

7 Pressure rating (stamped on)

8 Calibrating ring (to calibrate to neutral position after mounting valve; fix ring by pushing until it locks on to plug (6 A/F))

9 Mounting hole

10 P port, optional positioning on perimeter or front face

11 T port

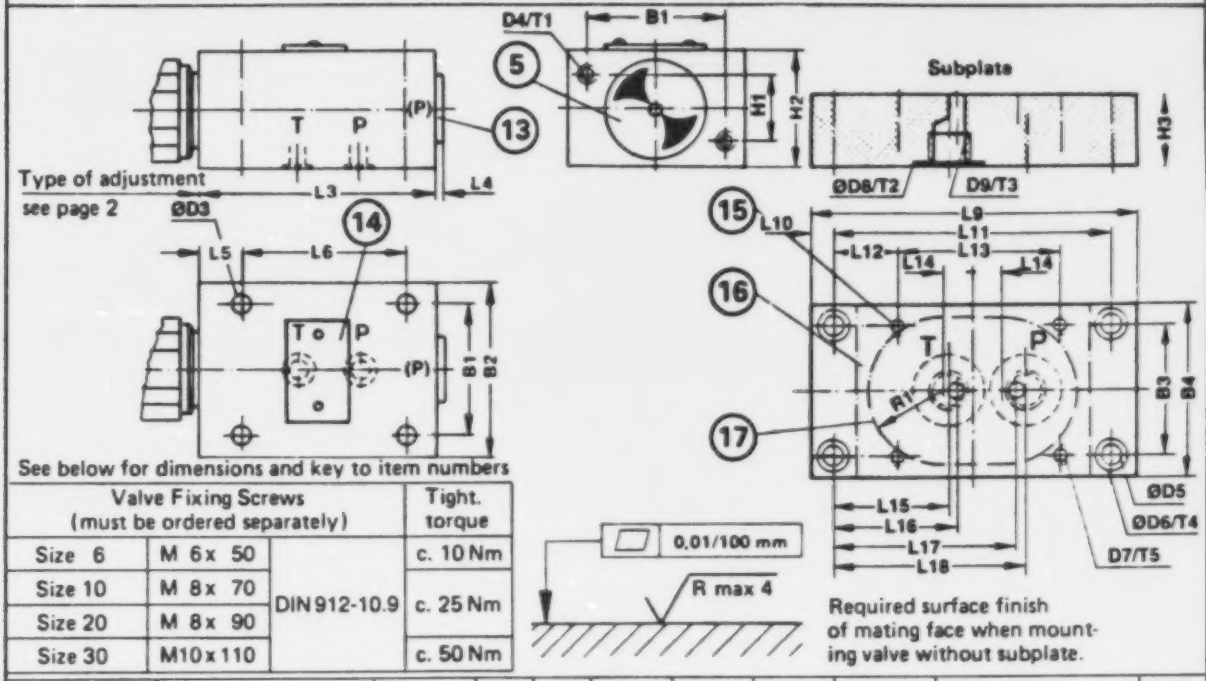
12 Space required for removal of key

Unit	Weight	D1	D2	D3	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	SW1	tight.torque	SW2*	SW3*	SW4*	SW5*	SW6*
Size 6	c. 0.4 kg	34	60	–	72	11	83	11	20	11	30	83	–	–	64,5	32	c. 120 Nm	30	* spanner size 19	6	–	30
Size 10	c. 0.5 kg	38			68		79					79			77	36	c. 140 Nm					–
Size 20	c. 1 kg	48			65		77	–	–	–	–	–			106	46	c. 170 Nm	36		–	13	
Size 30	c. 2.2 kg	63	–	80	83	–	–						11	56	131	60	c. 200 Nm	46				

Mounting Hole	D4	D5	D6	D7	D8	D9	L12	L13	L14	L15	L16	L17	L18	α1
Size 6	M 28 x 1,5	25^{H9}	6	15	24,9	6	15	19	30	35	45	56,5 ± 5.5	65	15°
Size 10	M 35 x 1,5	32^{H9}	10	18,5	31,9	10	18	23	35	41	52	67,5 ± 7.5	80	
Size 20	M 45 x 1,5	40^{H9}	20	24	39,9	20	21	27	45	54	70	91,5 ± 8.5	110	20°
Size 30	M 60 x 2	55^{H9}	30	38,75	54,9	30	23	29		60	84	113,5 ± 11.5	140	

H1

Unit Dimensions: Pressure Relief Valve for Subplate Mounting (Dimensions in mm)

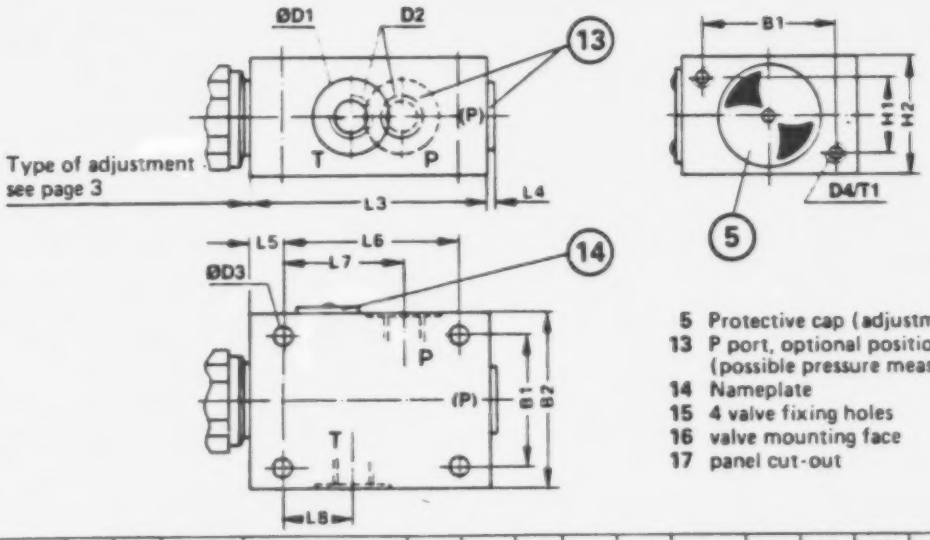


Valve Fixing Screws (must be ordered separately)			Tight. torque
Size 6	M 6 x 50	DIN 912-10.9	c. 10 Nm
Size 10	M 8 x 70		c. 25 Nm
Size 20	M 8 x 90		
Size 30	M10 x 110		c. 50 Nm

Subplate	Type	Weight	B3	B4	D5	D6	D7	ØD8	D9	H3
Size 6	G 300/01	1,5 kg	45	60	7	11	M 6	25	1/4" BSP	25
Size 10	(G 301/01) G 302/01	2 kg	60	80			M 8	(28) 34	(3/8") 1/2" BSP	
Size 20	(G 303/01) G 304/01	5,5 kg	70	100	11,5	17,5		(42) 47	(3/4") 1" BSP	40
Size 30	(G 305/01) G 306/01	8 kg	100	130			M10	(56) 61	(1 1/4") 1 1/2" BSP	

Subplate	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	T2	T3	T4	T5	R1
Size 6	110	8	94	22	55	10	39	42	62	65	1	15	9	15	25 +2
Size 10	135	10	115	27,5	70	12,5	40,5	48,5	72,5	80,5		(15) 16	9		30 +5
Size 20	170	15	140	20	100	20	(45) 42	54	85	(94) 97		20	13	(12) 22	40 +3
Size 30	190	12,5	165	17,5	130	22,5	42	52,5	102,5	(113) 117		24	11,5	22	55 +4

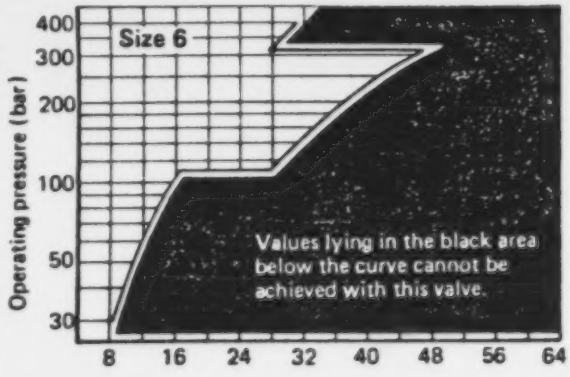
Unit Dimensions: Pressure Relief Valve for Threaded Connections (Dimensions in mm)



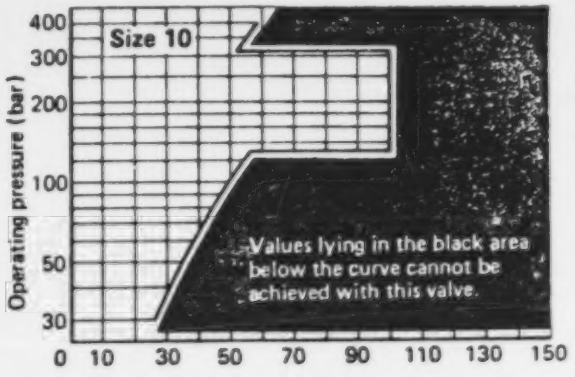
5 Protective cap (adjustment type "S")
13 P port, optional positioning (possible pressure measurement)
14 Nameplate
15 4 valve fixing holes
16 valve mounting face
17 panel cut-out

Unit	B1	B2	ØD1	D2	ØD3	D4	H1	H2	L3	L4	L5	L6	L7	L8	T1	Weight
Size 6	45	60	25	1/4" BSP	6,6	M 6	25	40	80	4	15	55	40	20	10	c. 1.5 kg
Size (8) + 10	60	80	(28) 34	(3/8") 1/2" BSP	9	M 8	40	60	100	4	20	70	49	21	20	c. 3.7 kg
Size (15) + 20	70	100	(42) 47	(3/4") 1" BSP			50	70	135	(4) 5,5		100	65	34		c. 6.4 kg
Size (25) + 30	100	130	(56) 61	(1 1/4") 1 1/2" BSP	11	M10	60	90	180	5,5	25	130	85	35	25	c. 13.9 kg

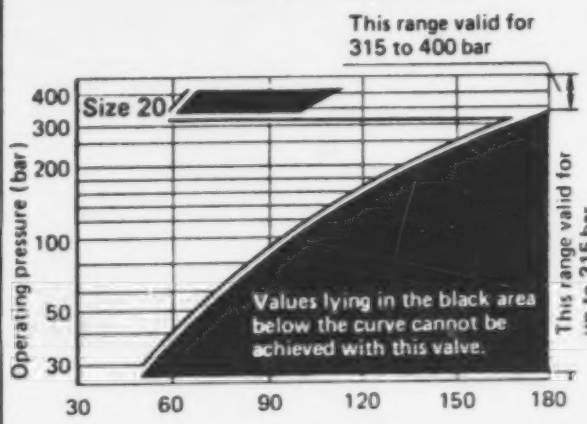
Design Tested Pressure Relief Valves Type DBD../..B



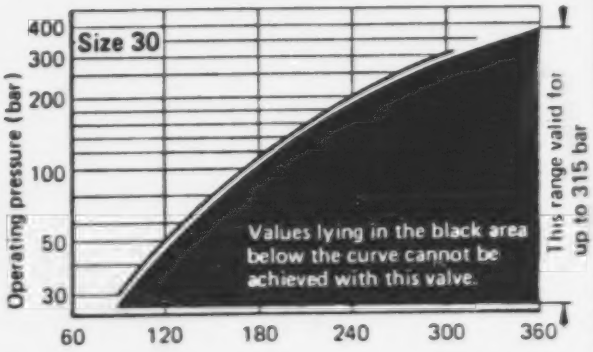
Flow Q in L/min in relation to
α_w-value; α_w for 30 to 110 bar = 0.1
α_w for 111 to 315 bar = 0.17
α_w for 316 to 400 bar = 0.1



Flow Q in L/min in relation to
α_w-value; α_w for 30 to 130 bar = 0.22
G for 131 to 315 bar constant 100 L/min
α_w for 316 to 400 bar = 0.13



Flow Q in L/min in relation to
α_w-value; α_w for 30 to 315 bar = 0.15
α_w for 315 to 400 bar = 0.05



Flow Q in L/min in relation to
α_w-value; α_w for 30 to 315 bar = 0.12

The ordering code for a design tested relief valve is made up of a model code and a component code

Size	Model code	Component code
6	DBDS 6K11/☐B DBDH 6K11/☐B DBDS 6G11/☐B DBDH 6G11/☐B DBDS 6P11/☐B DBDH 6P11/☐B	TÜV.SV.77-359.5.F.a_w.p.
10	DBDS 8G11/☐B DBDH 8G11/☐B DBDS 10K11/☐B DBDS 10G11/☐B DBDS 10P11/☐B DBDH 10K11/☐B DBDH 10G11/☐B DBDH 10P11/☐B	TÜV.SV.77-360.6.F.$\frac{a_w}{G}$.p

Size	Model code	Component code
20	DBDS 15G11/☐B DBDH 15G11/☐B DBDS 20K11/☐B DBDS 20G11/☐B DBDS 20P11/☐B DBDH 20K11/☐B DBDH 20G11/☐B DBDH 20P11/☐B	TUV.SV.77-361.10.F.a_w.p
30	DBDS 25G11/☐B DBDH 25G11/☐B DBDS 30K11/☐B DBDS 30G11/☐B DBDS 30P11/☐B DBDH 30K11/☐B DBDH 30G11/☐B DBDH 30P11/☐B	TUV.SV.77-362.15.F.a_w.p.

☐ Customer to insert required pressure rating in model code

Mannesmann Rexroth GmbH, Jahnstraße 3–5; D-8770 Lohr am Main; Tel.: 09352/180; Telex: 0689418
G.L. Rexroth Ltd. Cromwell Road St. Neots/Hunt., Cambs. PE192ES Tel. 0480/76041 Tlx. 32161

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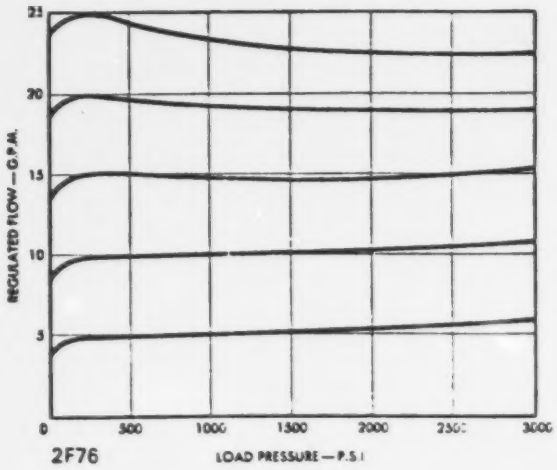
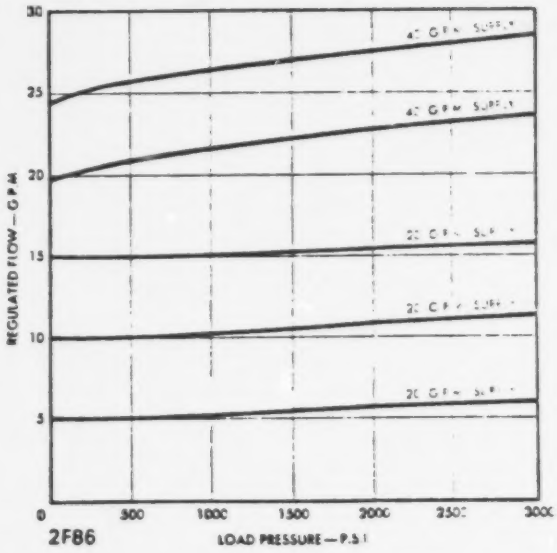
H1

LEVER ADJUST - 180° PRESSURE COMPENSATED FLOW CONTROLS RESTRICTIVE OR BYPASS STYLE



2F76



2F86

USE

For use in circuits where adjustable pressure compensated speed control is required, and for operator convenience the manual adjustment of the flow control is "Lever" operated through a 180° arc. Available in either the 2-ported Restrictive Style or 3-ported Bypass Style Flow Regulator.

OPERATION

The Lever Adjustment controls the size of the variable control orifice. The orifice arrangement uses a rotating inner and fixed outer sleeve with intersecting milled slots which results in a linear adjust curve. Both valves maintain constant regulated flow even with changes in the load pressure or input (pump) flow to valve.

Restrictive Style Valve - most commonly used in meter in and meter out applications. Flow through the control orifice produces a pressure drop sensed across the regulating section. Any tendency to exceed the flow setting of the valve increases this pressure differential until it exceeds the spring force and shifts the spool to throttle or restrict flow to the regulated port maintaining constant regulated flow.

Bypass Style Valve - most commonly used with fixed displacement pumps in meter in applications. Flow through the control orifice produces a pressure drop sensed across the regulating section. Any tendency to exceed the flow setting of the valve increases this pressure differential until it exceeds the spring force and shifts the spool allowing surplus oil to be bypassed to tank, thus maintaining constant regulated flow.

FEATURES

Rugged sturdy adjust design — built for hard duty.

Large easy to read numbered dial.

Built-in friction clutch — maintains setting yet allows quick easy readjustment.

Customer selected maximum regulated flow — gives full adjust sensitivity over the 180° arc.

SPECIFICATIONS

MATERIALS: Body, hi-strength wrought aluminum alloy
Internal Parts, hardened steel

RATED FLOW:
Restrictive Style - 2F76
Regulated - to 25 GPM (95 L/min)

Bypass Style - 2F86
Input - to 40 GPM (151 L/min)
Regulated - to 25 GPM (95 L/min)

WORKING PRESSURE: to 3000 PSI (210 bar)

FLOW REGULATORS

LEVER ADJUST
FOR OIL TO 25 G.P.M. (95 L/MIN.)
TO 3000 P.S.I. (210 bar)

fluid controls, inc.

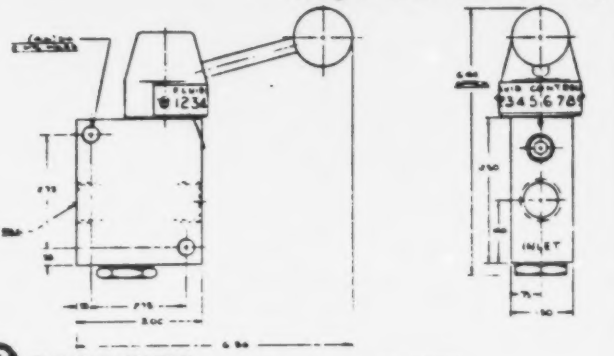
PART NUMBER EXAMPLE: **2F76 - L 6-6 - 25 S**

HOW TO ORDER

Where measurements are critical - request certified drawings.

❶ 2F76 RESTRICTIVE

Weight - 2 lb. 10 oz. (1.19 Kg)



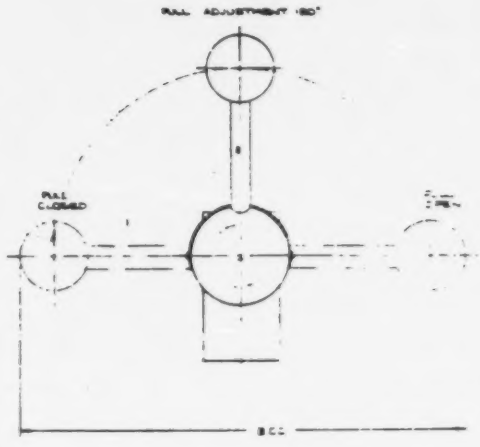
❸ PORT SIZE

	Inlet	Regulated
4* - 4*	½" NPTF	½" NPTF
6* - 6*	¾" NPTF	¾" NPTF
8T - 8T	½" SAE	½" SAE
12T - 12T	¾" SAE	¾" SAE

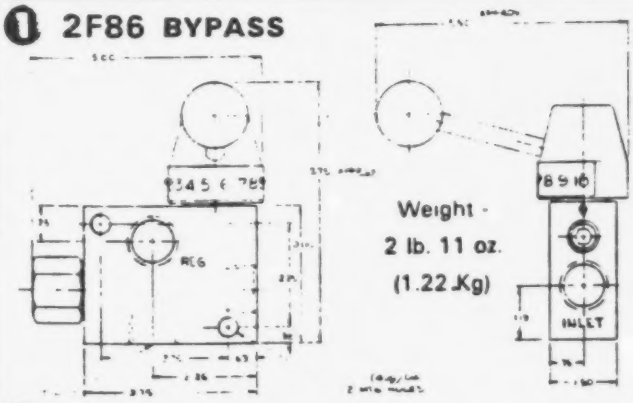
*Add W after each number for equivalent port with BSPPL thread

❷ ADJUST MEANS

L Lever Adjustment (180°)



❶ 2F86 BYPASS



Weight - 2 lb. 11 oz. (1.22 Kg)

❸ PORT SIZE

	Inlet	Tank	Reg
4* - 4* - 4*	½" NPTF	½" NPTF	½" NPTF
6* - 6* - 6*	¾" NPTF	¾" NPTF	¾" NPTF
8T - 8T - 8T	½" SAE	½" SAE	½" SAE
12T - 12T - 12T	¾" SAE	¾" SAE	¾" SAE

*Add W after each number for equivalent port with BSPPL thread

❹ ADJUSTABLE FLOW RANGE

25 0 - 25 GPM Standard (0 - 95 L min)

— Specify desired maximum flow range (0 - 6 GPM minimum flow range) (0 - 2.3 L/min)

❺ SEALS

S Buna N (For use with most industrial oils)

SV Viton A

Replaces: RA 22 001

REXROTH
WORLDWIDE HYDRAULICS
Bethlehem, Pa. 18018
215/694-8300

Check Valve Type S

Sizes 6 (1/4") to 30 (1 1/2") | up to 4500 PSI

for in-line mounting or as cartridge unit

RA 20377

Description

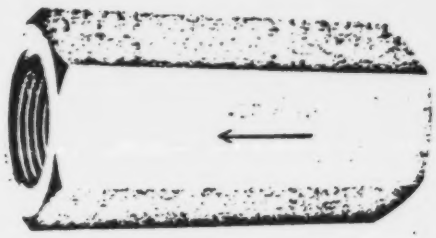
Issue: 1.75—U.S.A.

The check valves type S serve to give leakfree closure in one direction and free return flow in the other.

The stroke of the valve poppet is limited by a stop. The built-in spring supports the closing stroke, and also serves to hold the valve poppet in the closed position.

Four versions are available, with cracking pressures of 7, 22 or 45 PSI or without a spring.

A check valve cartridge is also available, suitable for mounting in manifold blocks. Two models are available: straight or angled valve cartridge.



Ordering Code

Model Number ▶ S | | A | | . | / 5 | *

Check valve	= S	Unit
Size 6 (1/4")	= 6	Size
Size 8 (3/8")	= 8	
Size 10 (1/2")	= 10	
Size 15 (3/4")	= 15	
Size 20 (1")	= 20	
Size 25 (1 1/4")	= 25	
Size 30 (1 1/2")	= 30	
In-line mounting	= A	Connections
Type No. 0 (without spring)	= 0	Design no.
Type No. 1 (cracking pressure 7 PSI) (Standard)	= 1	
Type No. 2 (cracking pressure 22 PSI)	= 2	
Type No. 3 (cracking pressure 45 PSI)	= 3	
none (specified by factory)	= 0	Modification no.

Add further details in clear text

Part numbers for check valve cartridge

Straight valve			
Type	No. 1	No. 2	No. 3
Size 6 (1/4")	301 889	301 896	301 903
Size 8 (3/8")	301 890	301 897	301 904
Size 10 (1/2")	301 891	301 898	301 905
Size 15 (3/4")	301 892	301 899	301 906
Size 20 (1")	301 893	301 900	301 907
Size 25 (1 1/4")	301 894	301 901	301 908
Size 30 (1 1/2")	301 895	301 902	301 909

Angled Valve			
Type	No. 1	No. 2	No. 3
Size 6 (1/4")	301 910	301 917	301 924
Size 8 (3/8")	301 911	301 918	301 925
Size 10 (1/2")	301 912	301 919	301 926
Size 15 (3/4")	301 913	301 920	301 927
Size 20 (1")	301 914	301 921	301 928
Size 25 (1 1/4")	301 915	301 922	301 929
Size 30 (1 1/2")	301 916	301 923	301 930

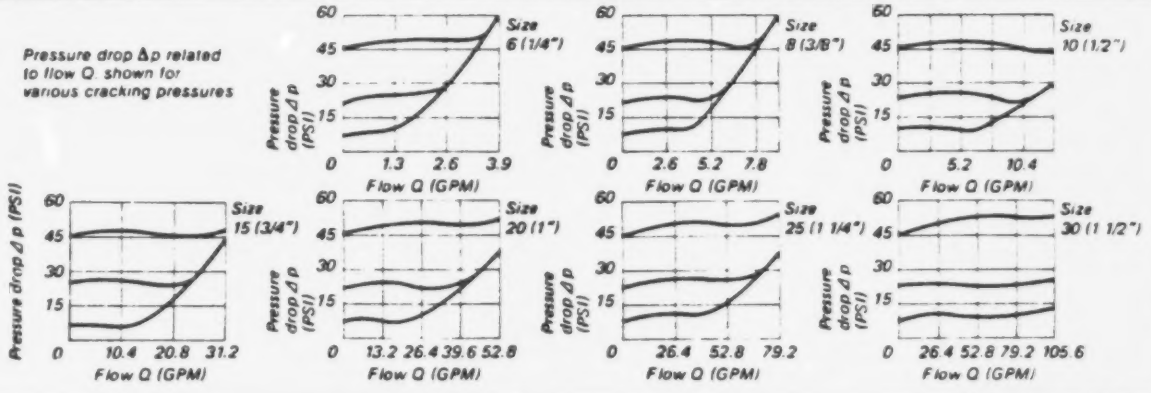
Technical Data (Valve description: RA 20 000) — Spares information: RE 20 377-E)

Hydraulic medium	Mineral oils
Fluid temperature range	-22°F to +176°F
Viscosity range	35 to 1750 SSU
Max. operating pressrue	4500 PSI

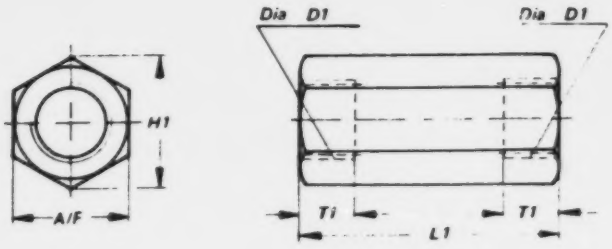
Cracking pressure (PSI)	7 (Type No. 1), 22 (No. 2), 45 (No. 3)						
Size	6 (1/4")	8 (3/8")	10 (1/2")	15 (3/4")	20 (1")	25 (1 1/4")	30 (1 1/2")
Flow Rating (GPM) Velocity = 20 ft/s	2.6	4.8	7.9	17.2	30.4	46.3	68.8

Performance Curves

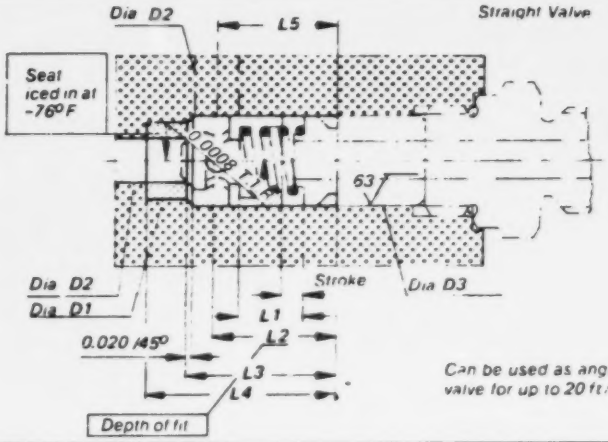
Pressure drop Δp related to flow Q, shown for various cracking pressures



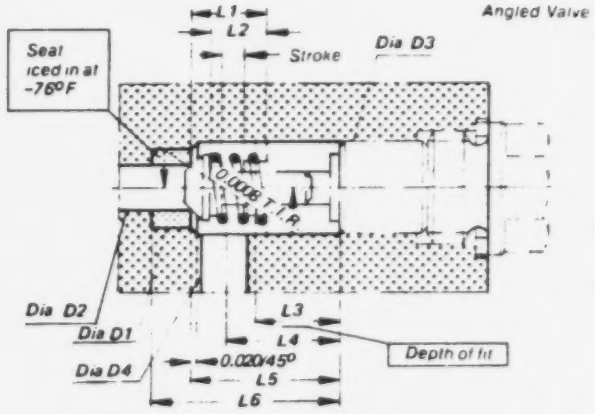
Unit Dimensions (in inches)



Size	6 (1/4")	8 (3/8")	10 (1/2")	15 (3/4")	20 (1")	25 (1 1/4")	30 (1 1/2")
D1	1/4" NPT	3/8" NPT	1/2" NPT	3/4" NPT	1" NPT	1 1/4" NPT	1 1/2" NPT
H1	0.866	1.102	1.358	1.634	2.087	2.717	2.953
L1	2.283	2.283	2.835	3.346	3.858	4.724	5.197
T1	0.472	0.472	0.551	0.630	0.709	0.787	0.866
A/F	0.748	0.945	1.181	1.417	1.811	2.362	2.559
Weight Lbs	0.22	0.44	0.66	1.1	2.2	4.4	5.5

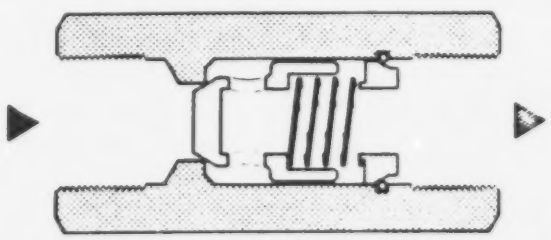


Size	6 (1/4")	8 (3/8")	10 (1/2")	15 (3/4")	20 (1")	25 (1 1/4")	30 (1 1/2")
D1	0.39429 0.39370	0.51251 0.51181	0.67000 0.66929	0.86696 0.86614	1.10318 1.10236	1.41830 1.41732	1.65452 1.65354
D2	0.236	0.315	0.394	0.591	0.787	0.984	1.181
D3	0.43413 0.43307	0.56224 0.55118	0.70972 0.70866	0.94618 0.94488	1.18240 1.18110	1.49759 1.49606	1.73381 1.73228
Stroke	0.157	0.157	0.157	0.197	0.197	0.276	0.276
L1	0.374	0.374	0.453	0.571	0.630	0.965	0.984
L2	0.748	0.709	0.827	1.063	1.142	1.535	1.654
L3	0.858	0.898	1.134	1.433	1.732	2.165	2.480
L4	1.173	1.291	1.528	1.906	2.323	2.874	3.268
L5	0.709	0.709	0.906	1.102	1.299	1.614	1.850
Weight Lbs	0.11	0.11	0.11	0.22	0.44	0.55	0.66

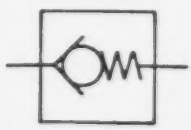


Size	6 (1/4")	8 (3/8")	10 (1/2")	15 (3/4")	20 (1")	25 (1 1/4")	30 (1 1/2")
D1	0.39429 0.39370	0.51251 0.51181	0.67000 0.66929	0.86696 0.86614	1.10318 1.10236	1.41830 1.41732	1.65452 1.65354
D2	0.236	0.315	0.394	0.591	0.787	0.987	1.181
D3	0.43413 0.43307	0.56224 0.55118	0.70972 0.70866	0.94618 0.94488	1.18240 1.18110	1.49759 1.49606	1.73381 1.73228
D4	0.236	0.315	0.394	0.591	0.787	0.984	1.181
Stroke	0.157	0.157	0.157	0.197	0.197	0.276	0.276
L1	0.441	0.464	0.563	0.709	0.740	1.122	1.122
L2	0.374	0.374	0.453	0.571	0.630	0.965	0.984
L3	0.394	0.630	0.630	0.709	0.906	1.220	1.457
L4	0.650	0.846	0.925	1.004	1.181	1.693	1.870
L5	0.807	1.043	1.161	1.339	1.594	2.264	2.500
L6	1.122	1.437	1.555	1.811	2.185	2.972	3.287
Weight Lbs	0.11	0.11	0.11	0.22	0.44	0.55	0.66

Section



Symbol



THE REXROTH CORPORATION/BETHLEHEM, PA. 18018

Telex 84 7418 — 2315 City Line Road L V I P — Phone: 215/694-8300

RA 20 2711 75 1.; Replaces RA 22 001 Printed in U.S.A.

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REXROTH
WORLDWIDE HYDRAULICS
BETHLEHEM, PA 18018

ENGINEERING DATA SHEET

COMBINATION THROTTLE & CHECK VALVE
type DRV & DRVP

1/4 to 2" Threaded and Manifold Mounting

NPT or SAE Threaded	5000 PSI (350 bar)	100 GPM (400 l/min)

RA
RA 32552
Issued: 8-1-79
Revised: 8-1-80

GENERAL DESCRIPTION...*This is an in-line or manifold mounted adjustable flow control valve with a return check valve. It has a bar stock body which is available with NPT or SAE thread in addition to the manifold mounted model.*

The valve incorporates a slotted needle to provide accurate control of flow. By turning the control knob counterclockwise, the flow increases uniformly. Free flow in the reverse direction is through the check valve passage of the valve body.

A color coded rising stem is provided to indicate the position of the valve opening. This visible indicator permits repeatable valve settings.

A set screw is provided in the hand knob to lock the setting.

OPERATING PRESSURE...*5000 PSI (350 bar)*

FLOW RATING...*See Valve Performance Charts*

OPERATING TEMPERATURE...*-20°F(-29°C) to +212°F(+100°C)*

FLUID RECOMMENDATIONS...*These valves are supplied, as a standard, with Viton seals. Viton seals are compatable with most hydraulic fluids.*

VISCOSITY RANGE...*35 SSU (2.8cSt) to 1750 SSU (380cSt)*

MOUNTING POSITION...*Optional*

WEIGHT...*See Installation Dimensions Charts*

ORDERING CODE

Model Number Example — DRV - 8 - 1.X/5 -V-S

MODEL NUMBER | DRV | - 1. | / | V | |

S =	Panel Mtg. Kit*
Omit =	If not needed

SEALS
V = Viton

PIPE CONNECTION
5 = NPT
12 = SAE

SERIES NO.
X = Numbered 0 to 9

This number is assigned by the factory and is used for ordering spare parts.

DESIGN NO.
1 = Steel

IN-LINE =	DRV
MANIFOLD =	DRVP

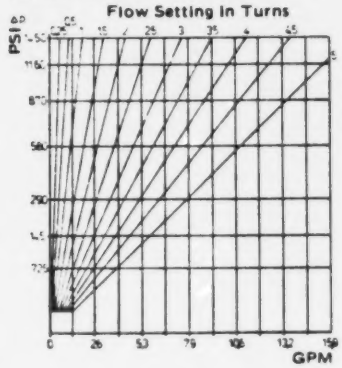
VALVE SIZE

SAE UNF-2B	NPT	ORDER CODE
7/16-20	1/4	= 8
9/16-18	3/8	= 10
3/4-16	1/2	= 12
1-1/16-12	3/4	= 16
1-5/16-12	1"	= 20
1-5/8-12	1-1/4	= 25
1-7/8-12	1-1/2	= 30
2-1/2-12	2"	= 40

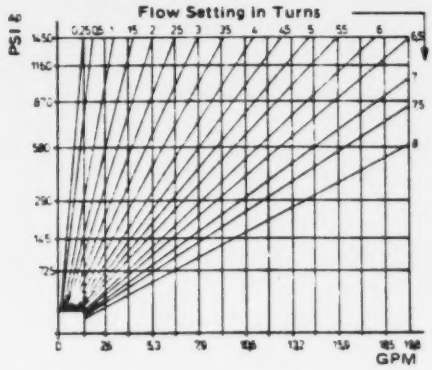
*Available with In-line models only

Test Performed with Hydraulic Oil 122°F (50°C) and 165 SSU (35cSt)

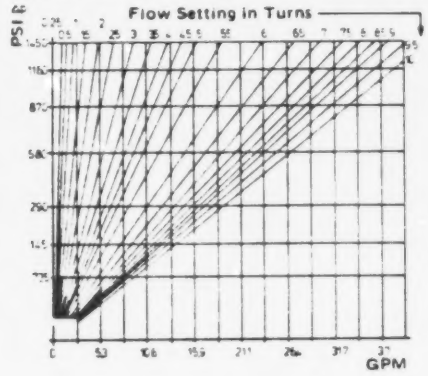
Types: DRV/DRVP - 8



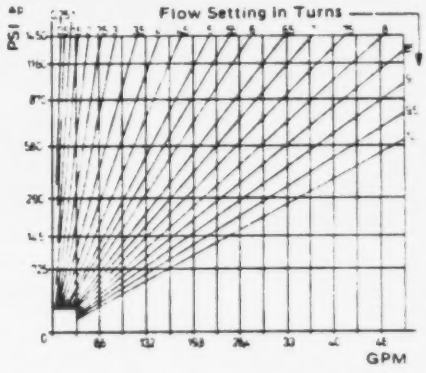
Types: DRV/DRVP - 10



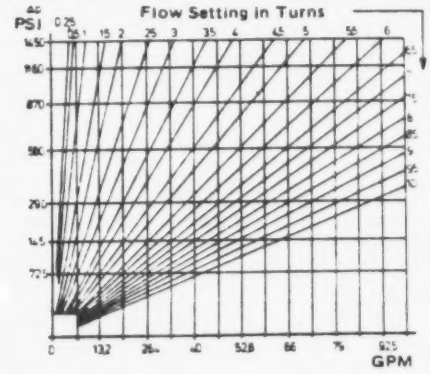
Types: DRV/DRVP - 12



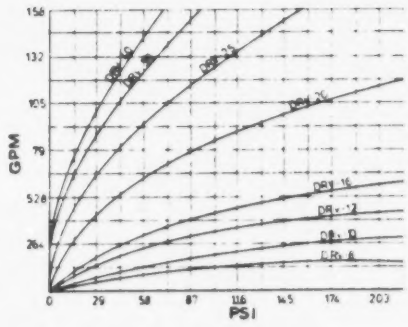
Types: DRV/DRVP - 16



Types: DRV/DRVP - 20/25/30/40



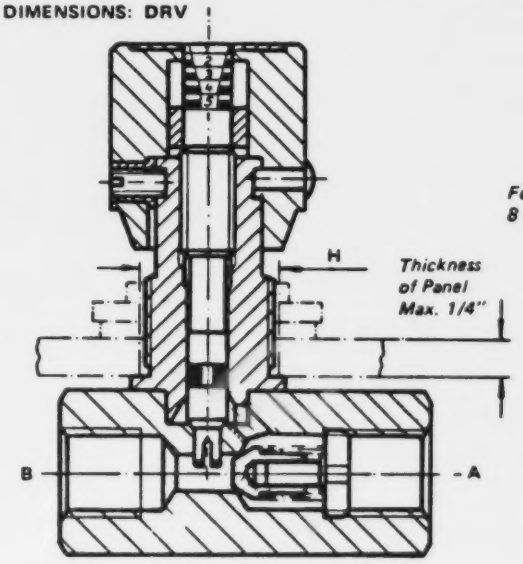
Flow direction: B → A
Δp curves free flow

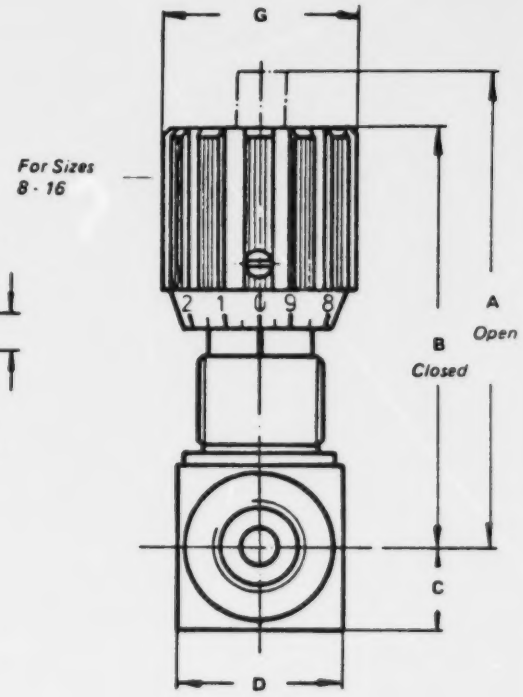


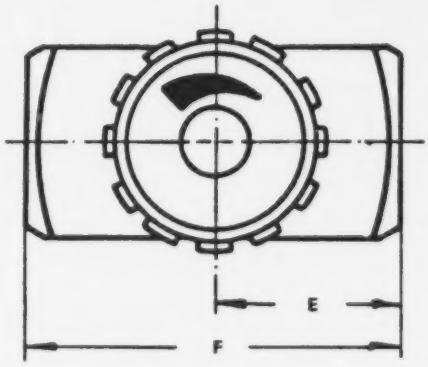
Pressure Drop Δp PSI

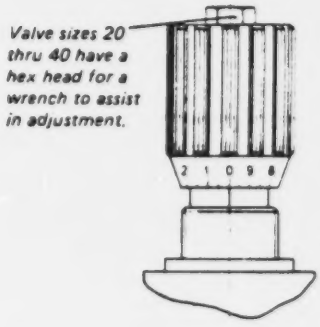
DIMENSIONS: Inches (mm) RA 32552

INSTALLATION DIMENSIONS: DRV





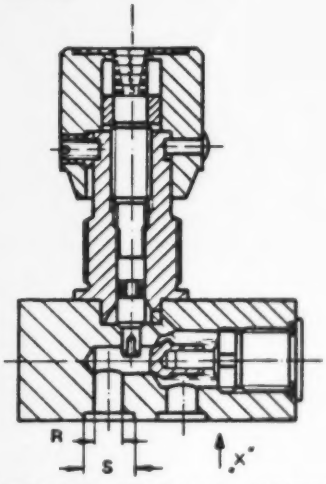


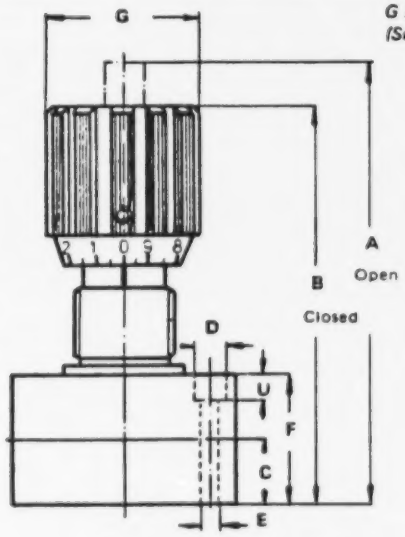


INSTALLATION DIMENSIONS inches and (mm) - weight, lbs. (kg.)

VALVE SIZE		A	B	C	D Sq.	E	F	G Dia.	H Dia.	Weight
8	1/4	2.84 (72)	2.56 (65)	0.50 (13)	0.98 (25)	1.31 (29)	2.16 (55)	1.14 (29)	0.75 (19)	0.6 (0.3)
10	3/8	2.91 (74)	2.63 (67)	0.59 (15)	1.19 (30)	1.61 (41)	2.56 (65)	1.14 (29)	0.75 (19)	1.0 (0.4)
12	1/2	3.63 (86)	3.25 (83)	0.69 (18)	1.38 (35)	1.75 (44)	2.88 (73)	1.50 (38)	0.91 (23)	1.8 (0.8)
16	3/4	4.17 (106)	3.81 (97)	0.88 (22)	1.75 (44)	2.25 (57)	3.47 (88)	1.50 (38)	0.91 (23)	2.8 (1.3)
20	1"	5.69 (145)	5.03 (128)	1.00 (26)	1.97 (50)	3.03 (77)	5.00 (127)	1.94 (50)	1.50 (38)	5.3 (2.4)
25	1-1/4	5.91 (150)	5.25 (134)	1.19 (30)	2.38 (60)	3.66 (93)	5.63 (143)	1.94 (50)	1.50 (38)	7.8 (3.5)
30	1-1/2	6.13 (156)	5.44 (138)	1.38 (35)	2.75 (70)	4.25 (108)	5.63 (143)	1.94 (50)	1.50 (38)	10 (4.5)
40	2"	6.50 (165)	5.81 (148)	1.75 (44)	3.53 (90)	5.13 (131)	6.50 (165)	1.94 (50)	1.50 (38)	17 (7.8)

INSTALLATION DIMENSIONS: DRVP
ANSI STANDARDS

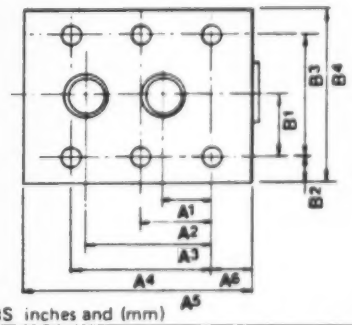


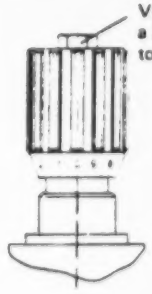


INSTALLATION DIMENSIONS inches and (mm) - weight, lbs. (kg.)

VALVE SIZE		A	B	C	D Dia.	E Dia.	F	R	S Dia.	U	WEIGHT
8	1/4	3.13 (80)	2.84 (72)	0.39 (10)	0.43 (11)	0.27 (7)	0.99 (25)	0.28 (7)	0.50 (13)	0.28 (7)	1.1 (0.5)
10	3/8	3.34 (85)	3.03 (84)	0.50 (13)	0.43 (11)	0.27 (7)	0.98 (25)	0.39 (10)	0.62 (16)	0.28 (7)	1.8 (0.8)
12	1/2	4.19 (106)	3.78 (96)	0.63 (16)	0.43 (11)	0.27 (7)	1.25 (32)	0.51 (13)	0.73 (19)	0.28 (7)	2.7 (1.2)
16	3/4	5.03 (128)	4.66 (118)	0.88 (22)	0.55 (14)	0.35 (9)	1.78 (45)	0.67 (17)	0.96 (24)	0.36 (9)	5.8 (2.6)
20	1"	6.69 (170)	6.03 (153)	0.98 (25)	0.55 (14)	0.35 (9)	1.97 (50)	0.87 (22)	1.20 (28)	0.36 (9)	8.6 (3.9)
25	1-1/4	6.88 (175)	5.91 (150)	1.69 (43)	0.71 (18)	0.43 (11)	2.16 (56)	1.12 (29)	1.48 (38)	0.44 (11)	13 (5.9)
30	1-1/2	7.68 (195)	6.69 (170)	1.47 (37)	0.79 (20)	0.55 (14)	2.97 (75)	1.38 (35)	1.91 (49)	0.50 (13)	20 (9.1)
40	2"	8.66 (220)	8.00 (204)	1.97 (50)	0.79 (20)	0.55 (14)	3.94 (100)	1.81 (46)	2.26 (57)	0.50 (13)	26 (12)

VIEW "X"





Valve sizes 20 thru 40 have a 3/4" hex head for a wrench to assist in adjustment.

MANIFOLD DIMENSIONS inches and (mm)

VALVE SIZE		A1	A2	A3	A4	A5	A6	B1	B2	B3	B4
8	1/4	0.198 (5)	—	1.19 (31)	1.38 (35)	2.50 (64)	0.56 (14)	0.67 (17)	0.24 (6)	1.34 (34)	1.81 (46)
10	3/8	0.16 (4)	—	1.16 (30)	1.32 (34)	2.75 (70)	0.73 (19)	0.75 (19)	0.25 (6)	1.50 (38)	2.00 (51)
12	1/2	0.16 (4)	—	1.34 (34)	1.50 (38)	3.16 (84)	0.83 (21)	0.88 (22)	0.26 (7)	1.75 (44)	2.27 (58)
16	3/4	0.43 (11)	1.50 (38)	2.55 (66)	3.00 (76)	4.10 (104)	0.55 (14)	1.06 (27)	0.31 (8)	2.13 (54)	2.75 (70)
20	1"	0.75 (19)	1.87 (48)	3.00 (76)	3.75 (95)	5.00 (127)	0.63 (16)	1.18 (30)	0.31 (8)	2.38 (60)	3.00 (76)
25	1-1/4	0.80 (21)	2.36 (60)	3.91 (101)	4.73 (120)	6.50 (165)	1.182 (30)	1.50 (38)	0.47 (12)	3.00 (76)	3.94 (100)
30	1-1/2	0.95 (24)	2.82 (72)	4.69 (119)	5.63 (143)	7.31 (186)	1.094 (28)	1.81 (46)	0.45 (11)	3.62 (92)	4.53 (115)
40	2"	0.75 (19)	2.64 (67)	4.25 (108)	5.25 (133)	7.56 (192)	1.688 (43)	2.19 (56)	0.56 (14)	4.38 (111)	5.50 (140)

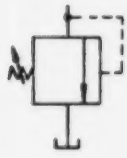
Fluid Controls, Inc.

RELIEF VALVES

PILOT OPERATED
SLIDING SPOOL AND POPPET STYLE
FOR OIL - TO 40 G.P.M. (151 L/MIN), 6000 P.S.I. (420 bar)

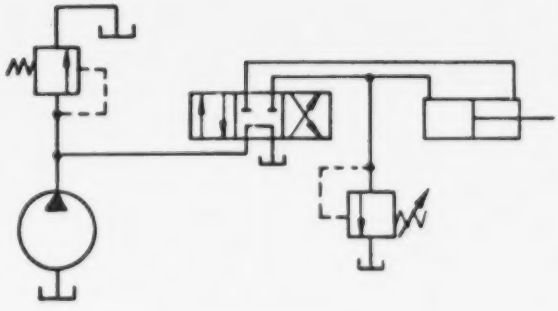
USE

The pilot operated sliding spool and poppet models combine high accuracy and excellent pressure vs. flow characteristics. Used to limit system pressure even under conditions of widely varying flow.



OPERATION

When inlet pressure exceeds the relief setting the pilot section opens. This pilot flow causes a pressure imbalance across the main section which opens and allows relief flow to tank.



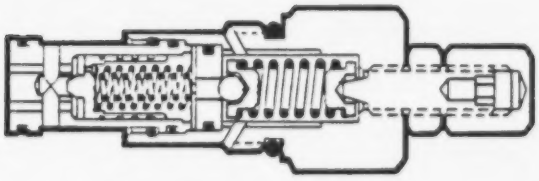
FEATURES

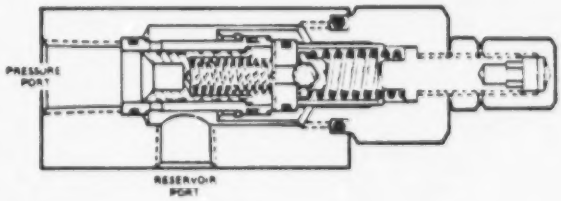
High accuracy - of pilot operated design.

Cartridge construction - for installation in your own manifold.

Long trouble free life - with hardened matched working parts.

1 A 20 — **SLIDING SPOOL TYPE CARTRIDGE CONSTRUCTION** — **1 A 30**



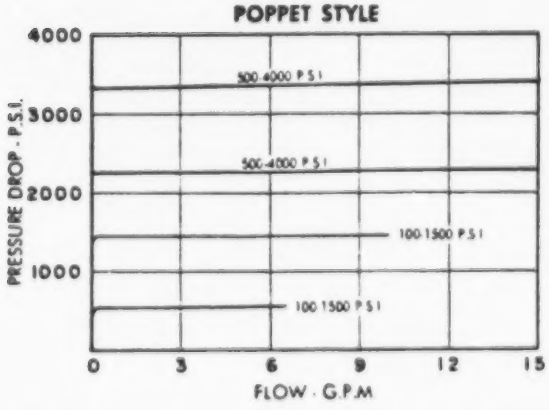


MATERIALS: Body, hi-strength wrought aluminum alloy
Internal parts, hardened steel Cartridge housing, steel

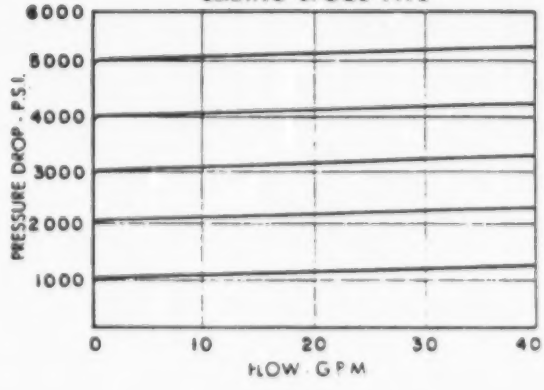
RATED FLOW & WORKING PRESSURE: Poppet style to 15 G.P.M., (57 L/MIN) 4000 P.S.I. (280 bar)
Sliding spool to 40 G.P.M., (151 L/MIN) 6000 P.S.I. (420 bar)

RESEAT: 1A20's 75% of set pressure
RESEAT: 1A30's 80% of set pressure

POPPET STYLE



SLIDING SPOOL TYPE



RELIEF VALVES

PILOT OPERATED
SLIDING SPOOL AND POPPET STYLE
FOR OIL - TO 40 G.P.M. (151 L/MIN), 6000 P.S.I. (420 bar)

Fluid Controls, inc.

PART NUMBER EXAMPLE:

1A33 - R 8 - 30 S
① ② ③ ④ ⑤

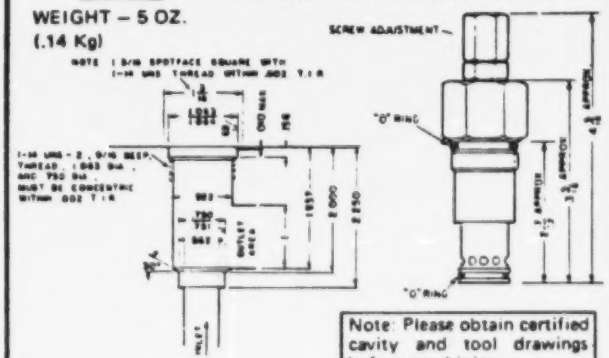
Pressure setting made at 3 GPM (11.4 L/MIN)

Where measurements are critical - request certified drawings.

① 1A20 Cartridge Only, Poppet Type

1A30 Cartridge Only, Sliding Spool Type

WEIGHT – 5 OZ. (.14 Kg)

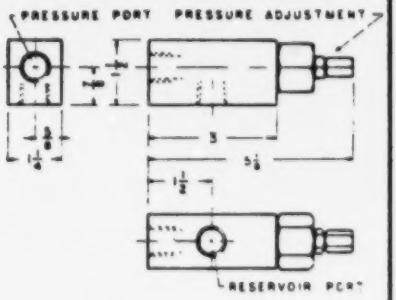


Note: Please obtain certified cavity and tool drawings before machining.

① 1A21 Complete Valve, Poppet Type

1A31 Complete Valve, Sliding Spool Type

WEIGHT – 12 OZ. (.34 Kg)



③ PORT SIZE

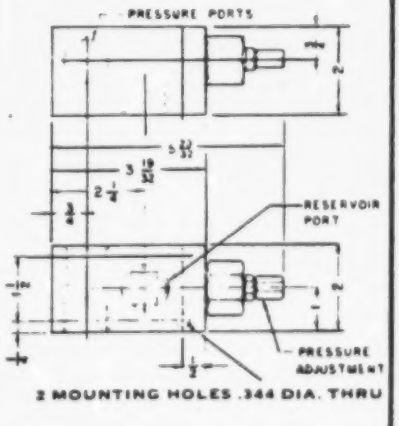
2	¼" NPTF
3	⅜" NPTF
4T	¼" SAE
2W	¼" BSPPL
3W	⅜" BSPPL

① 1A32 Complete Valve, Sliding Spool Type

WEIGHT – 1 LB. 7 OZ. (.65 Kg)

③ PORT SIZE

3	⅜" NPTF
4	½" NPTF
6	¾" NPTF
8T	½" SAE
12T	¾" SAE
3W	⅜" BSPPL
4W	½" BSPPL
6W	¾" BSPPL

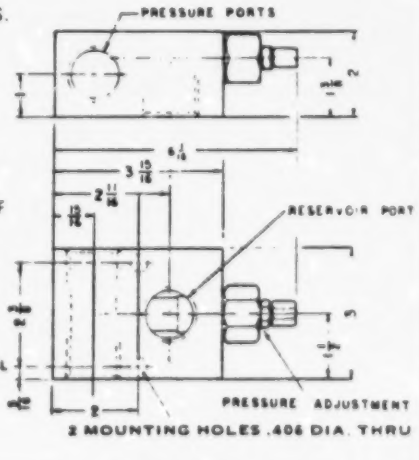


① 1A33 Complete Valve, Sliding Spool Type

WEIGHT – 2 LBS. (.91 Kg)

③ PORT SIZE

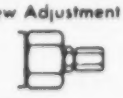
8	1" NPTF
16T	1" SAE
8W	1" BSPPL



② ADJUST MEANS

Screw Adjustment

F



Handknob

R

④ ADJUSTABLE PRESSURE RANGE

Setting made at 3 GPM

Note: Poppet Type Only

15	150 to 1500 P.S.I. (7-105 bar) Std. Setting 500 P.S.I.
40	500 to 4000 P.S.I. (35-280 bar) Std. Setting 1500 P.S.I.

Note: Sliding Spool Type Only

10	25 to 1000 P.S.I. (1.7-70 bar) Std. Setting 100 P.S.I.
15	100 to 1500 P.S.I. (7-105 bar) Std. Setting 500 P.S.I.
30	150 to 3000 P.S.I. (10-210 bar) Std. Setting 1500 P.S.I.
60	500 to 6000 P.S.I. (35-420 bar) Std. Setting 3000 P.S.I.

⑤ SEALS

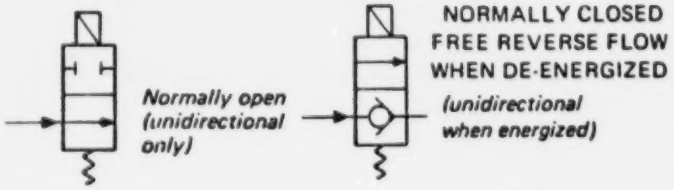
Consult factory for absolute seal compatibility

	Buna N
S	For use with mineral base hydraulic oil
SV	Viton A

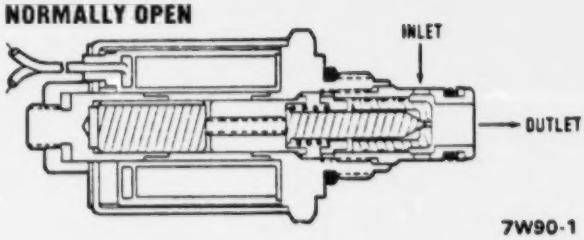
Fluid Controls, Inc.

SOLENOID CARTRIDGE

PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 5 G.P.M. (19 L/MIN), 3000 P.S.I. (210 bar)

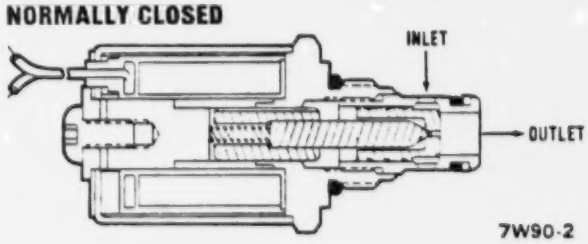


NORMALLY OPEN



7W90-1

NORMALLY CLOSED



7W90-2

USE

To be used as a two-way directional control in any hydraulic system with up to 5 GPM flow. Also can be used to remotely operate or pilot large pilot operated valves requiring up to 5 GPM pilot flow.

OPERATION

Normally Open.

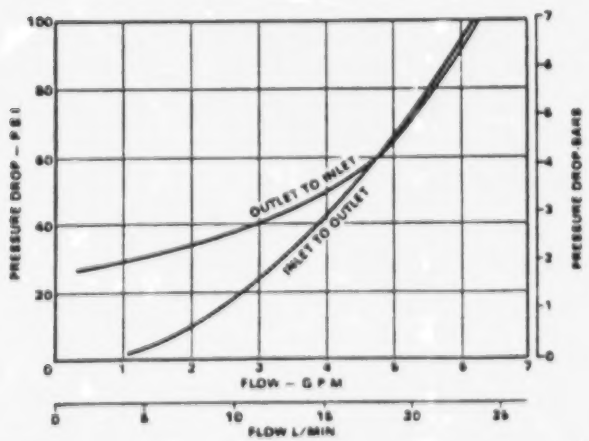
Spring tension holds the pilot poppet away from the orifice seat on the main poppet. An axial groove on the O.D. of the main poppet allows pilot flow to pass through the poppet nose. This flow pattern creates a pressure imbalance on the main poppet and causes the poppet to shift open allowing complete flow to pass through the outlet port. When the solenoid coil is energized, the armature is magnetically forced to slide the push pin and pilot poppet forward. The poppet blocks pilot flow and the main poppet shifts to a completely closed position.

Normally Closed.

Spring tension holds the pilot poppet against the main poppet and both pilot and main flow through the valve is blocked. When the solenoid coil is energized the armature is magnetically forced to pull the pilot poppet from the orifice seat and pilot flow occurs. The pilot flow creates a pressure imbalance on the main poppet and the valve shifts open.

Optional Application.

The normally closed valve will allow reverse flow in the closed mode and is unidirectional in the energized (open) mode.



FEATURES

Reliable, excellent performance.
Cartridge construction for use in your own cavity or complete in body.
Hardened steel working parts.
Replaceable weather resistant coil.

SPECIFICATIONS

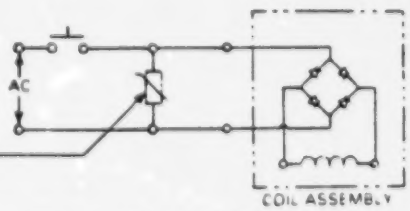
WORKING PRESSURE: Rated to 3000 P.S.I. (210 bar)

VOLTAGE:
12, 24, 36 VDC, 12 Watts
115 VAC (±10%)
50-60 hz. 12 amps
230 VAC (±10%)
50-60 hz. 07 amps

All coils rated for continuous operation.
AC coils use an internal AC/DC rectifier.

PLEASE NOTE:
Coils contain a full wave bridge rectifier rated for reverse voltage peaks of 1000 Volts Maximum. This is adequate for most systems. If voltage transients in your system are greater than 1000 Volts P.I.V., voltage transient suppressors such as metal oxide varistors should be added in parallel with the coil.

SUPPRESSOR
115 VAC - USE
G E MOV-VP130A10
OR EQUAL
230 VAC - USE
G E MOV-VP250A20
OR EQUAL



LEAKAGE:
In closed position – Inlet to Outlet @ 3000 psi 5 drops per minute maximum with 135 s.s.u. oil @ 100° F.

MATERIALS: Cartridge housing, steel.
Valve body, hi strength wrought aluminum
Internal parts, hardened steel, stainless steel

SOLENOID CARTRIDGE

PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 5 G.P.M. (19 L/MIN), 3000 P.S.I. (210 bar)

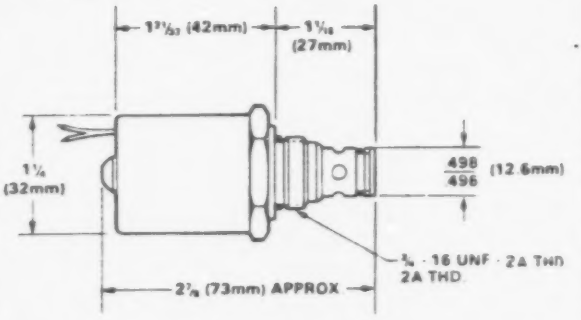
Fluid Controls, Inc.

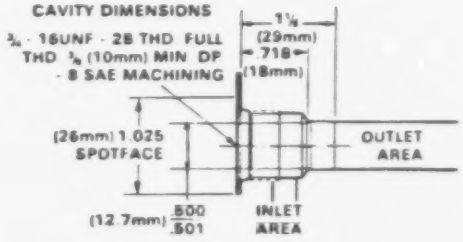
PART NUMBER EXAMPLE: **HOW TO ORDER**

7W91 - 12 - L 12 S

❶ ❷ ❸ ❹ ❺ ❻

❶ 7W90 Cartridge Only

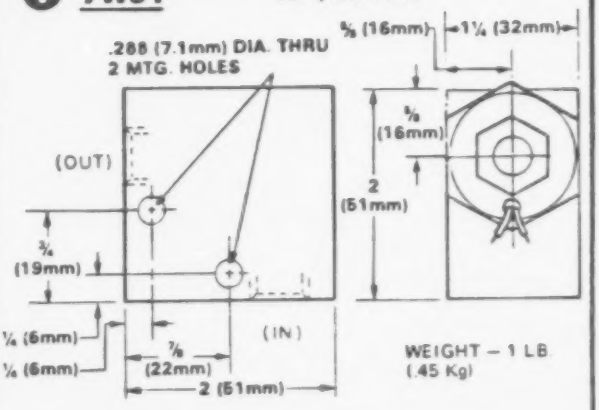


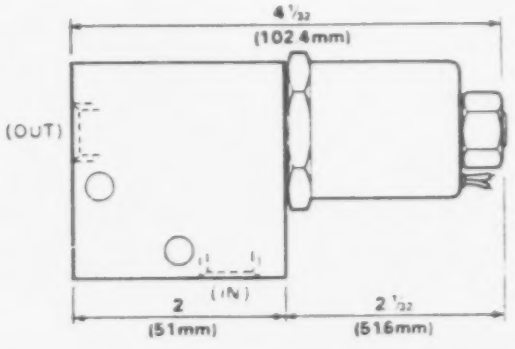


Refer to coil catalog page for dimensions of available coils

Note: Please obtain certified cavity and tool drawings before machining

❶ 7W91 Complete valve





❷ VALVE CONFIGURATION

1	Normally Open
2	Normally Closed

❸ PORT SIZE

2	1/4" NPTF
3	3/8" NPTF
6T	3/8" SAE
3W	3/8" BSPPL
2W	1/4" BSPPL

❹ COIL TERMINATIONS

—	Pigtails		
C	Conduit	D	Double Screw
H	DIN	S	Double Spade
B	Heavy Cord	L	Heavy Lead
G	Single Screw	M	Military Standard

❺ VOLTAGE

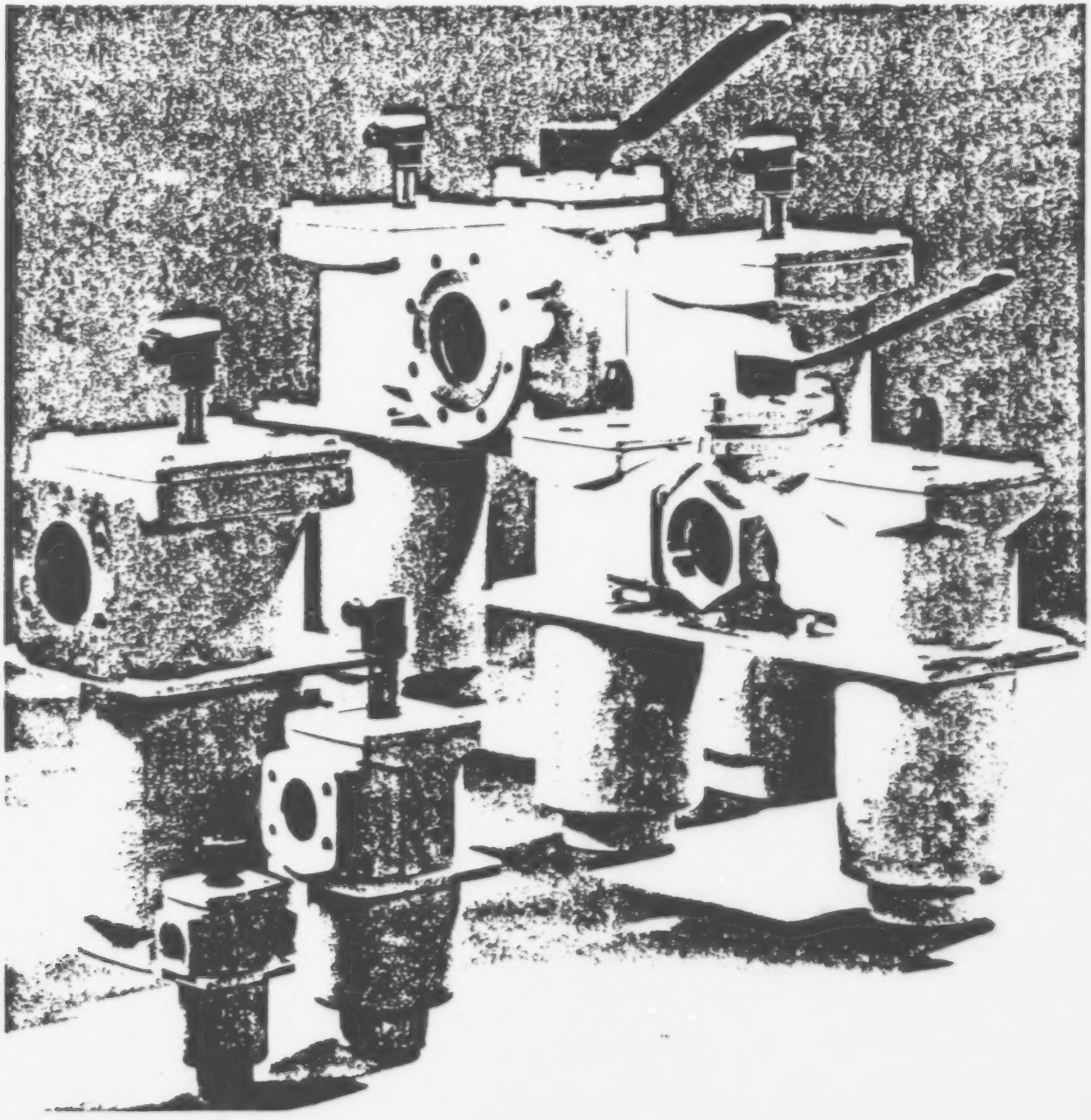
			WIRE COLOR
12	12	VOLT D C	Black
24	24	VOLT D C	Yellow
36	36	VOLT D C	Red
115	115	VOLT A C	White
230	230	VOLT A C	Blue

❻ SEALS

S	Buna N
SV	Viton A

HYCON
Corporation
Lehigh Valley Industrial Park
P.O. Box 2626 · City Line Rd. & Avenue C
Bethlehem, Pa. 18017
Telephone (215) 266-0100 · Telex 847328

IN-TANK RETURN LINE FILTERS SERIES RF



1. DESCRIPTION

1.1. ELEMENTS

1.1.1. Metal Fiber Elements (Cleanable)

The 4*plus*4 metal fiber element has the following 8 unique advantages:

- High contamination retention due to depth filtration.
- Constant high hold-back rate insures long filter life.
- Low flow resistance with compact design.
- Longer service life due to depth filtration.

plus

- High differential collapse pressure due to high inherent stability.
- Protection against corrosion by use of stainless steel filter material and zinc plated steel parts.
- High temperature resistance due to metal fiber element.
- Economical because of cleanable element.

1.1.2. Wire Mesh Element (Cleanable)

- High differential collapse pressure due to high inherent stability.
- High temperature resistance due to metal fiber element.
- Protection against corrosion by use of stainless steel filter material and zinc plated steel parts.
- Economical because of cleanable element.

1.1.3. Paper Fleece Element (Throw-away)

- High contamination retention due to depth filtration.
- Low flow resistance because no bonding agent is used in filter material.
- High inherent stability due to wire screen support on both sides of filter material.
- High temperature resistance as paper fleece is free of phenolic resin.

1.1.4. Betamicron Element of Inorganic Fibers (Throw-away)

- Excellent absorption of finest particles over a wide differential pressure range.
- High contamination retention due to large specific absorption area.
- Excellent chemical resistance is achieved by using epoxy resin in the process of impregnating and bonding of inorganic fibers.
- Protection against damage due to high burst pressure resistance (for example: during cold start-ups and differential pressure surges).

1.2. FILTER HOUSINGS

The in-tank return line filters type RF and RFD are suitable for direct mounting in oil reservoirs. The filters are designed so that pressure surges caused by sudden openings of the large control valves are absorbed without damage. A container for the purpose of trapping dirt surrounds the filter element. When the element is removed, the container is drawn out with it, so that any residual dirt is not allowed to flow back into the tank. The in-tank return line filter can be fitted with a mechanical or electrical clogging indicator.

2. TECHNICAL DATA

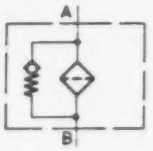
2.1. GENERAL

2.1.1. Hydraulic Symbols

In-tank Return Line Filter

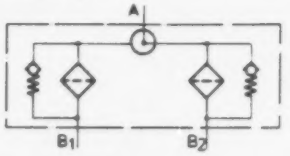
Single Filter

Model A



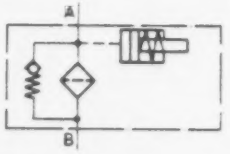
Double Filter

Model A

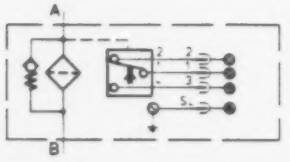


Filter with dirt clogging indicator

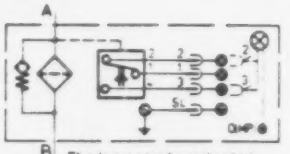
Model B



Model C

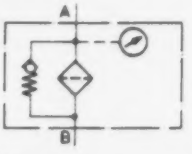


Model D

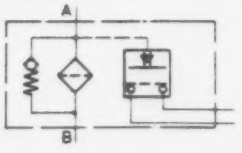


The lamp can be activated either on closing contact (3) or on opening contact (2)

Model E



Model F



2.1.2. **Type Code** (also ordering example)

RF V 160 G 10 D 1 . 1 / L 24 - V

Filter Type
RF - In-Tank Return Line Filter
RFD - In-Tank Dual Return Line Filter

Filter Material of Element
BN - Betamicron N-Element
V - Metal Fiber (4*plus*4)
P - Paper
W - Wire Mesh
] max. Δp see 2.2.1.

Size

30	8 GPM
60	16 GPM
110	30 GPM
160	48 GPM
240	72 GPM
330	90 GPM
660	180 GPM
950	285 GPM
1300	380 GPM

] Nominal GPM Rating
Note Viscosity and Application

Port Connection
G - Threaded
F - Flange
] consult paragraph 2.1.6.

Filtration in Micron

10	Betamicron N	(BN)	consult paragraph 2.2.8.
20	Metal Fiber (4*plus*4)	(V)	Nominal
	Paper	(P)	Nominal
25	Wire Mesh	(W)	
74	Wire Mesh	(W)	
149	Wire Mesh	(W)	

(other micron ratings on request)

Type of Indicator
A = without clogging indicator
B = with visual clogging indicator
C = with electrical clogging indicator
D = with electrical and visual clogging indicator
E = with manometer
F = with pressure switch (up to 42 Volt only)
] See Clogging Indicator Brochure

Type Number
1 = Standard connection
2 =] Reduced connection (only RF series) –
3 =] consult paragraph 2.1.6.

Modification Number

Supplementary Details
L 24 = Lamp for 24 Volt
L 48 = Lamp for 48 Volt
L 110 = Lamp for 110 Volt
L 220 = Lamp for 220 Volt
] D-Type clogging indicator only
- 5 = NPT Threaded (RF only)
- V = Viton Seals
- T = Air Breather included (only RF 30)
- 1 = Magnetic Strip (included in basket)
12 = SAE Straight Thread (special order)

2.1.3. **Design**
In-Tank Return Line Filter

2.1.4. **Mounting Method**
Inline or base flange for reservoir mounting

2.1.5. **Approximate Weight**

		with element lbs.	with element kg	without element lbs.	without element kg
RF	30	0.9	0.4	0.7	0.3
RF	60	2.0	0.9	1.7	0.75
RF	110	2.4	1.1	2.0	0.9
RF	160	4.0	1.8	3.3	1.5
RF	240	5.0	2.3	4.0	1.8
RF	330	8.6	4.1	8.2	3.4
RF	660	44.0	20.0	41.0	18.5
RF	950	92.0	41.5	86.0	39.0
RF	1300	102.0	46.0	95.0	43.0
RFD	60	11.0	4.9	10.0	4.6
RFD	110	12.0	5.4	11.0	5.0
RFD	160	25.0	11.1	23.0	10.5
RFD	240	27.0	12.3	25.0	11.3
RFD	330	45.0	20.3	42.0	18.9
RFD	660	133.0	60.0	127.0	57.5
RFD	950	276.0	125.0	265.0	120.0
RFD	1300	315.0	143.0	302.0	137.0

2.1.6. **Connection Size**

RF	30	Type No. 1 = ½" NPT-N/A
RF	60	Type No. 1 = 1" NPT-SAE-16 Type No. 2 = ¾" NPT-SAE-12 Type No. 3 = ½" NPT-SAE- 8
RF	110	Type No. 1 = 1" NPT-SAE-16 Type No. 2 = ¾" NPT-SAE-12 Type No. 3 = ½" NPT-SAE- 8
RF	160	Type No. 1 = 1½" NPT-SAE-24 Type No. 2 = 1¼" NPT-SAE-20
RF	240	Type No. 1 = 1½" NPT-SAE-24 Type No. 2 = 1¼" NPT-SAE-20
RF	330	Type No. 1 = 2" NPT or SAE Flange (3000 PSI)
RF	660	Type No. 1 = 3" SAE Flange (500 PSI)
RF	950	Type No. 1 = 3½" SAE Flange (500 PSI)
RF	1300	Type No. 1 = 4" SAE Flange (500 PSI)
RFD	60	Type No. 1 = 1" NPT
RFD	110	Type No. 1 = 1" NPT
RFD	160	Type No. 1 = 1½" NPT
RFD	240	Type No. 1 = 1½" NPT
RFD	330	Type No. 1 = 2" NPT
RFD	660	Type No. 1 = 3" NPT
RFD	950	Type No. 1 = DIN Flange NW 80, ND 16
RFD	1300	Type No. 1 = DIN Flange NW 100, ND 16

2.1.7. **Mounting Position**
Vertical

2.1.8. **Direction of Flow**
Inlet: Side-Horizontal
Outlet: Bottom-Vertical

2.2. HYDRAULIC DATA

2.2.1. **Operating Pressure**
RF – pmax. 435 PSI = 30 BAR
RFD – pmax. 232 PSI = 16 BAR
RF 30 – pmax. 145 PSI = 10 BAR

max. Δp for Element
Metal Fiber 4*plus*4:
1015 PSI = 70 BAR
Wire Mesh:
435 PSI = 30 BAR
Paper:
145 PSI = 10 BAR
Betamicron N:
435 PSI = 30 BAR
(according to ISO 2941)

2.2.2. **Temperature Range**
min . . . max . . . =
+14° F . . . + 212° F
– 10° C . . . + 100° C

2.2.3. **Fluid Compatibility**
(Test data in accordance with ISO 2943)

2.2.4. **Continuous Flow Stability according to ISO/DIS 3724**
High continuous fatigue resistance is achieved by using heavy mechanical support on both sides of the filter media, and a filter media of high inherent stability.

2.2.5. **Trip Pressure of Indicators**
Δp = 29 PSI = 2 BAR

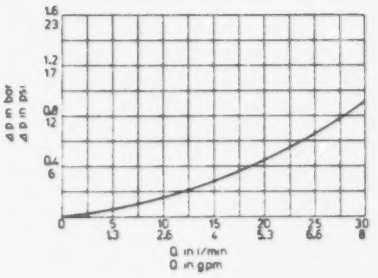
2.2.6. **Cracking Pressure of By-pass Valve**
Δp = 43 PSI = 3 BAR

2.2.7. **Δp-Q-Curves to ISO/DIS 3968.2 Class B**

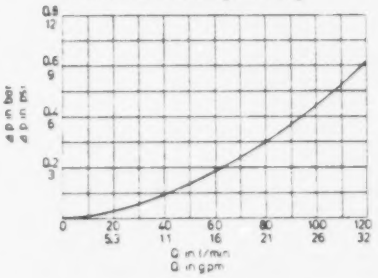
Housing Curves

Applicable for mineral oils with a specific gravity of 0.86 and a kinematical viscosity of 141 SSU. During turbulent flows, differential pressure changes in proportion to specific gravity. During laminar flows, differential pressure changes in proportion to specific gravity and viscosity.

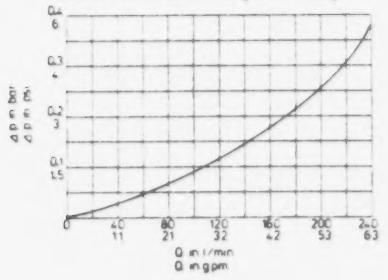
RF 30 G



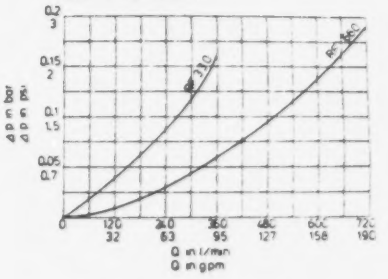
RF/RFD 60/110 (1" Port)



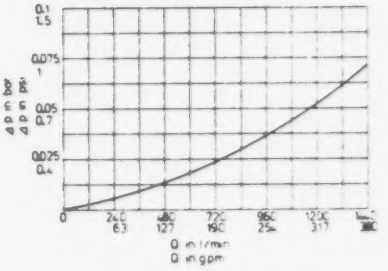
RF/RFD 160/240 (1½" Port)



RF/RFD 330 (2" Port)
RF/RFD 660 F



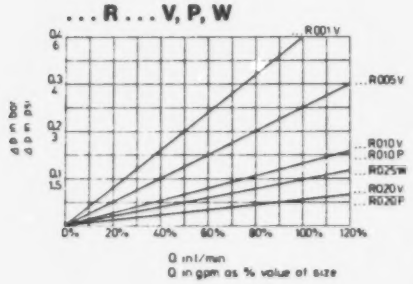
RF/RFD 950 F/1300 F



Element Curves

The element curves are based on mineral oil with a kinematical viscosity of 141 SSU. The differential pressure across the element changes proportionally to the viscosity.

. . . R . . . V, P, W



To find Δp of element, divide application flow by the proper conversion factor below to find percentage, then read Δp from the chart above.

Conversion Factors

Size	Factor
30	7.9
60	15.8
110	29
160	42.2
240	63.3
330	87
660	174.1
950	251.3
1300	343.9

$$\frac{\text{Application GPM}}{\text{Conversion Factor}} = \%\ \text{Size}$$

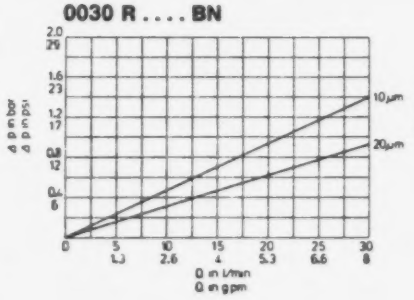
Example:

25 Wire Mesh, 60 GPM, Size 240

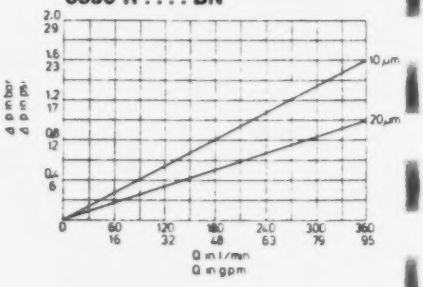
$$\frac{60\ \text{GPM}}{63.3} = .947 = 95\ \%\ \text{of Flow}$$

95 % = 1.5 PSI Δp

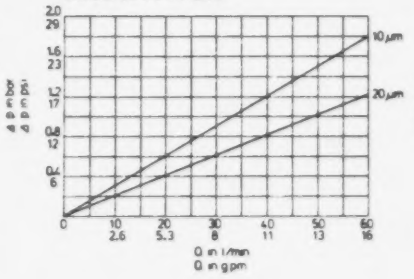
0030 R . . . . BN



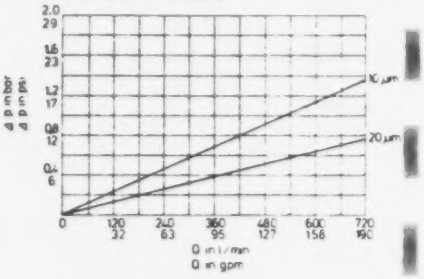
0330 R . . . . BN



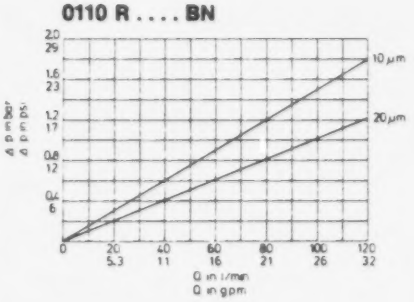
0060 R . . . . BN



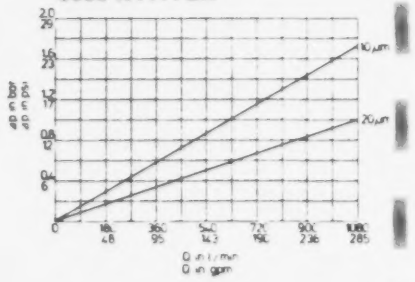
0660 R . . . . BN



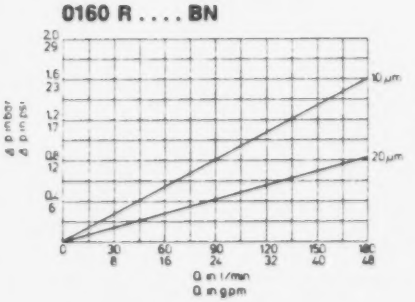
0110 R . . . . BN



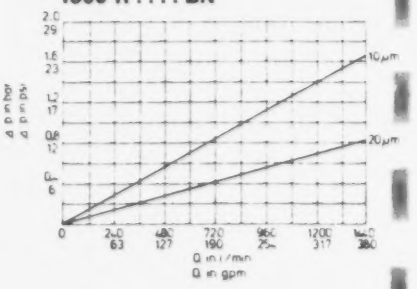
0950 R . . . . BN



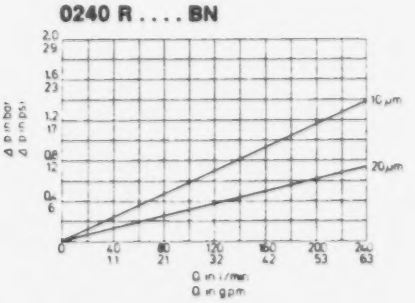
0160 R . . . . BN



1300 R . . . . BN



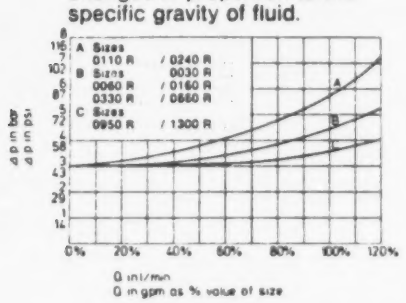
0240 R . . . . BN



By-pass Curves

These by-pass curves are for mineral oil with a specific gravity of 0.86.

The valve pressure differential changes in proportion to the specific gravity of fluid.



Total Differential Pressure for the Complete Filter

Total differential Pressure for the complete filter is established by adding housing differential pressure and clean element differential pressure.

2.2.8. **Filtration Efficiency**

Retention Rates for 4 *plus* 4, Wire Mesh and Paper Elements

This test involves a large amount of contaminants (ACFTD) being introduced during the beginning of the test with gradual separation of these particles by the filter over a one hour period.

The filter element must retain 90 - 95 % of the particles larger than the given micron rating.

Multi-Pass Filtration Efficiency Ratings to ISO/DIS 4572 for Betamicron-Elements

The allocation of the β_x-values to the filter element differential pressure is based on the cracking pressure of the differential pressure indicator and the by-pass valve.

The multi-pass data was determined on the factory test stand according to ISO/DIS 4572 (to maximum filter efficiency).

Filtration Quotients β_x dependent upon Δp across Element

$$\beta_x = \frac{\text{Particles upstream of Filter} \geq x\ \mu m}{\text{Particles downstream of Filter} \geq x\ \mu m}$$

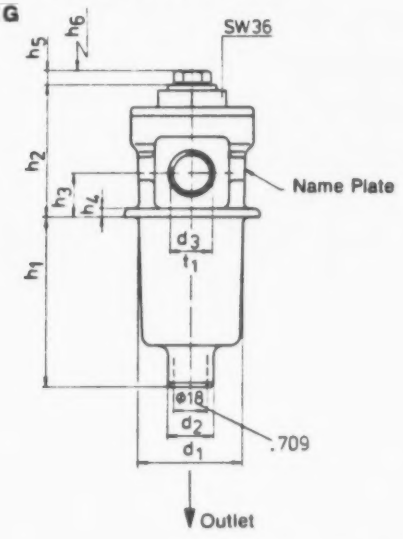
β_x	Betamicron Element Type			
	... R 010 BN		... R 020 BN	
	Δp = 30.45 PSI 2.1 BAR	Δp = 50.75 PSI 3.5 BAR	Δp = 30.45 PSI 2.1 BAR	Δp = 50.75 PSI 3.5 BAR
β_3	1.4	1.4	-	-
β_4	1.9	1.9	-	-
β_6	4.6	4.4	-	-
β_8	13.3	12.1	-	-
β_{10}	55	44	2.5	2.2
β_{15}	> 1000	> 1000	15.2	13
β_{20}	-	-	72	63
β_{25}	-	-	900	> 1000
β_{30}	-	-	> 1200	∞
	$\beta_{10,9} \geq 100$	$\beta_{11,2} \geq 100$	$\beta_{20,4} \geq 100$	$\beta_{21} \geq 100$

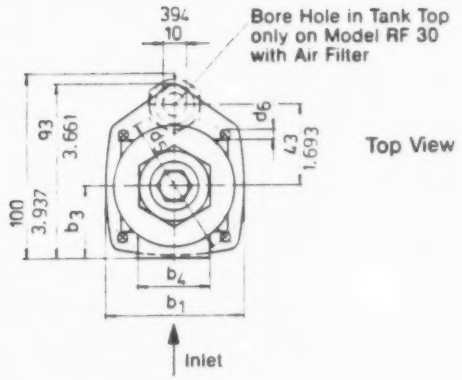
2.2.9. **Quality Control**

Continuous filtration efficiency tests and quality control by means of the bubble test to ISO 2942, guarantees highest quality standards.

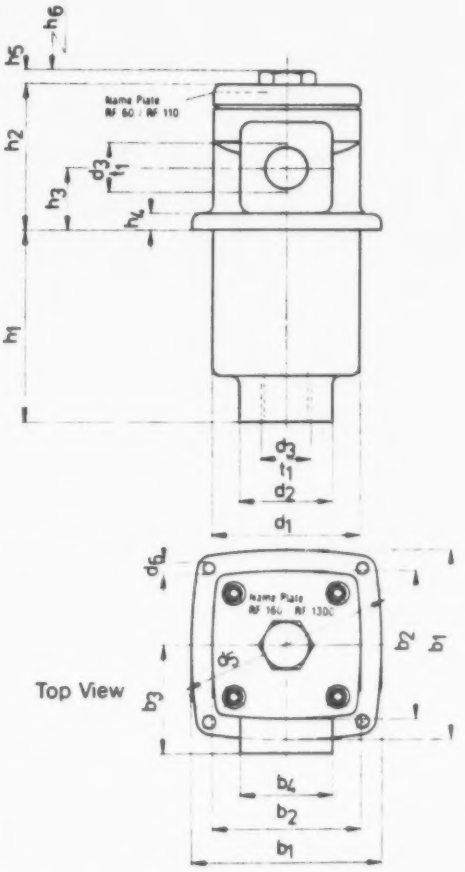
3. DIMENSIONS: RF

RF 30 G

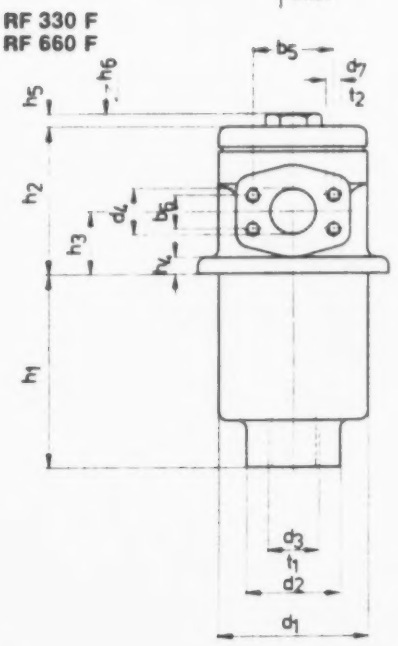




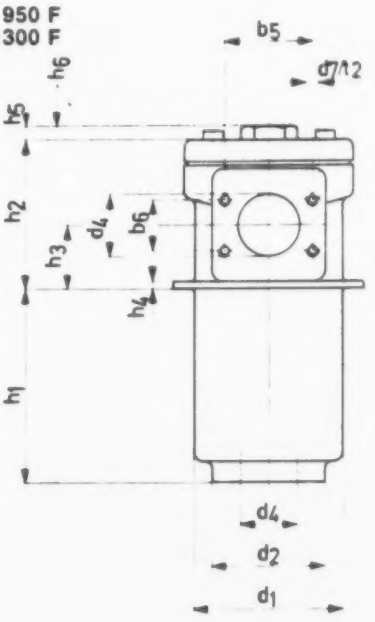
RF 60 G
RF 110 G
RF 160 G
RF 240 G
RF 330 G



RF 330 F
RF 660 F



RF 950 F
RF 1300 F

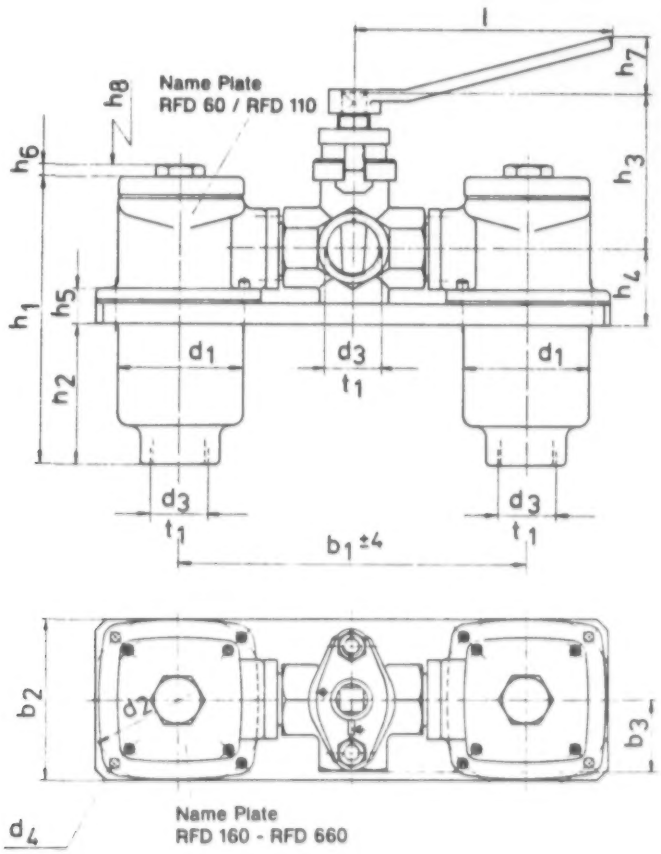


Type		b_1	b_2	b_3	b_4	b_5	b_6	$\varnothing d_1$	d_2	d_3	$\varnothing d_4$	$\varnothing d_5$
RF 30 G ... 1.1	inch	2.795	–	1.496	1.496	–	–	2.126	⌀ .945	½ NPT	–	3.071
	mm	71	–	38	38	–	–	54	⌀ 24	R ½"	–	78
RF 60 G ... 1.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	1 NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R 1"	–	100
RF 60 G ... 2.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	¾ NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R ¾"	–	100
RF 60 G ... 3.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	½ NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R ½"	–	100
RF 110 G ... 1.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	1 NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R 1"	–	100
RF 110 G ... 2.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	¾ NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R ¾"	–	100
RF 110 G ... 3.1	inch	3.543	2.874	1.890	1.772	–	–	2.835	⌀ 1.772	½ NPT	–	3.937
	mm	90	73	48	45	–	–	72	⌀ 45	R ½"	–	100
RF 160 G ... 1.1	inch	4.724	3.898	2.598	2.283	–	–	3.858	⌀ 2.283	1½ NPT	–	5.315
	mm	120	99	66	58	–	–	98	⌀ 58	R 1½"	–	135
RF 160 G ... 2.1	inch	4.724	3.898	2.598	2.283	–	–	3.858	⌀ 2.283	1¼ NPT	–	5.315
	mm	120	99	66	58	–	–	98	⌀ 58	R 1¼"	–	135
RF 240 G ... 1.1	inch	4.724	3.898	2.598	2.283	–	–	3.858	⌀ 2.283	1½ NPT	–	5.315
	mm	120	99	66	58	–	–	98	⌀ 58	R 1½"	–	135
RF 240 G ... 2.1	inch	4.724	3.898	2.598	2.283	–	–	3.858	⌀ 2.283	1¼ NPT	–	5.315
	mm	120	99	66	58	–	–	98	⌀ 58	R 1¼"	–	135
RF 330 G ... 1.1	inch	5.984	5.000	3.346	–	–	–	5.039	⌀ 2.992	2 NPT	–	6.693
	mm	152	127	85	–	–	–	128	⌀ 76	R 2"	–	170
RF 330 F ... 1.1	inch	5.984	5.000	3.346	–	3.071	1.693	5.039	⌀ 2.992	2 NPT	1.968	6.993
	mm	152	127	85	–	78	43	128	⌀ 76	R 2"	50	170
RF 660 F ... 1.1	inch	7.717	6.575	4.331	–	4.193	2.441	6.575	⌀ 4.331	3 NPT	3.150	8.661
	mm	196	167	110	–	106.5	62	167	⌀ 111	R 3"	80	220
RF 950 F ... 1.1	inch	10.039	8.661	5.315	–	4.752	2.756	7.874	□ 6.614	–	3.543	11.417
	mm	255	220	135	–	120.7	70	200	□ 168	–	90	290
RF 1300 F ... 1.1	inch	10.039	8.661	5.709	–	5.126	3.071	7.874	□ 6.614	–	3.937	11.417
	mm	255	220	145	–	130.2	78	200	□ 168	–	100	290

Type		$\varnothing d_6$	d_7	h_1	h_2	h_3	h_4	h_5	h_6	t_1	t_2
RF 30 G ... 1.1	inch	.197	–	3.504	2.638	.945	.197	.433	3.543	.551	–
	mm	5	–	89	67	24	5	11	90	14	–
RF 60 G ... 1.1	inch	.217	–	3.720	2.795	1.201	.315	.433	3.543	.709	–
	mm	5.5	–	94.5	71	30.5	8	11	90	18	–
RF 60 G ... 2.1	inch	.217	–	3.720	2.795	1.201	.315	.433	3.543	.630	–
	mm	5.5	–	94.5	71	30.5	8	11	90	16	–
RF 60 G ... 3.1	inch	.217	–	3.720	2.795	1.201	.315	.433	3.543	.630	–
	mm	5.5	–	94.5	71	30.5	8	11	90	16	–
RF 110 G ... 1.1	inch	.217	–	6.378	2.795	1.201	.315	.433	6.299	.709	–
	mm	5.5	–	162	71	30.5	8	11	160	18	–
RF 110 G ... 2.1	inch	.217	–	6.378	2.795	1.201	.315	.433	6.299	.630	–
	mm	5.5	–	162	71	30.5	8	11	160	16	–
RF 110 G ... 3.1	inch	.217	–	6.378	2.795	1.201	.315	.433	6.299	.630	–
	mm	5.5	–	162	71	30.5	8	11	160	16	–
RF 160 G ... 1.1	inch	.256	–	4.843	3.386	1.457	.315	.433	5.118	.787	–
	mm	6.5	–	123	86	37	8	11	130	20	–
RF 160 G ... 2.1	inch	.256	–	4.843	3.386	1.457	.315	.433	5.118	.787	–
	mm	6.5	–	123	86	37	8	11	130	20	–
RF 240 G ... 1.1	inch	.256	–	7.165	3.386	1.457	.315	.433	7.480	.787	–
	mm	6.5	–	182	86	37	8	11	190	20	–
RF 240 G ... 2.1	inch	.256	–	7.165	3.386	1.457	.315	.433	7.480	.787	–
	mm	6.5	–	182	86	37	8	11	190	20	–
RF 330 G ... 1.1	inch	.354	–	5.551	5.118	2.362	.394	.433	7.087	1.063	–
	mm	9	–	141	130	60	10	11	180	27	–
RF 330 F ... 1.1	inch	.354	½ UNC	5.551	5.118	2.362	.394	.433	7.087	1.063	.906
	mm	9	M 12	141	130	60	10	11	180	27	23
RF 660 F ... 1.1	inch	.551	9/16 UNC	9.689	6.496	3.150	.394	.433	12.598	1.260	.984
	mm	14	M 14	246	65	80	10	11	320	32	25
RF 950 F ... 1.1	inch	.709	⅝ UNC	10.000	7.677	3.622	.394	.433	13.780	–	.866
	mm	18	M 16	254	195	92	10	11	350	–	22
RF 1300 F ... 1.1	inch	.709	⅝ UNC	13.189	9.370	4.646	.394	.433	18.110	–	.984
	mm	18	M 16	335	238	118	10	11	460	–	25

DIMENSIONS RFD:

RFD 60 G
RFD 110 G
RFD 160 G
RFD 240 G
RFD 330 G
RFD 660 G



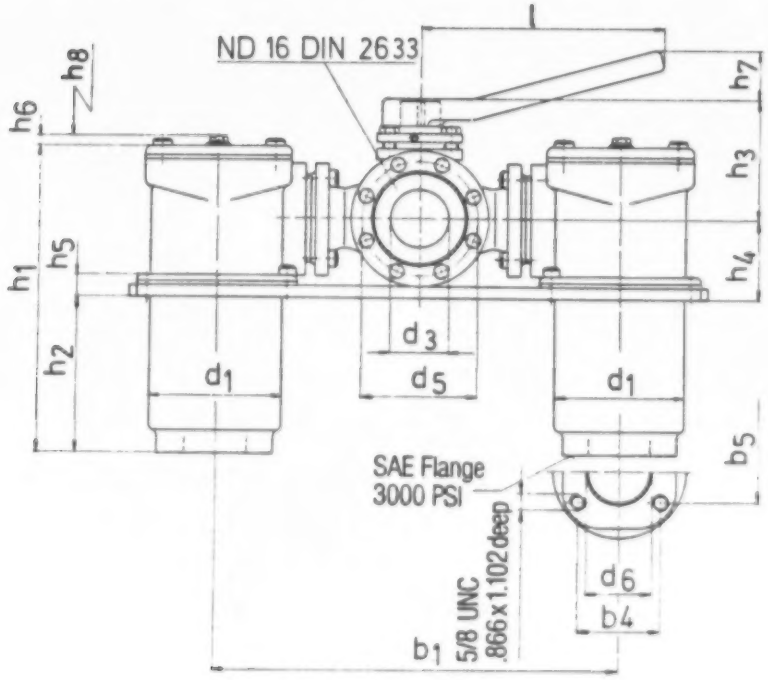
Type		$b_1 \pm a^*$	b_2	b_3	$\varnothing d_1$	$\varnothing d_2$	d_3	$\varnothing d_4$	h_1	h_2
RFD 60 G	inch	7.717	3.543	1.575	2.835	3.937	1 NPT	.217	6.496	3.110
	mm	196	90	40	72	100	R 1"	5.5	165	79
RFD 110 G	inch	7.717	3.543	1.575	2.835	3.937	1 NPT	.217	9.173	5.787
	mm	196	90	40	72	100	R 1"	5.5	233	147
RFD 160 G	inch	10.315	4.724	2.165	3.858	5.315	1½ NPT	.256	8.228	4.005
	mm	262	120	55	98	135	R 1½"	6.5	209	103
RFD 240 G	inch	10.315	4.724	2.165	3.858	5.315	1½ NPT	.256	10.551	6.378
	mm	262	120	55	98	135	R 1½"	6.5	268	162
RFD 330 G	inch	12.992	5.948	2.677	5.039	6.693	2 NPT	.354	10.669	5.039
	mm	330	152	68	128	170	R 2"	9	271	128
RFD 660 G	inch	16.496	7.717	3.465	6.575	8.661	3 NPT	.551	16.181	9.134
	mm	419	196	88	167	220	R 3"	14	411	232

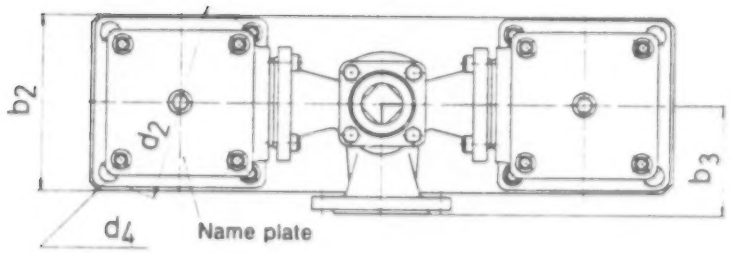
* a = 0.157 inch = 4 mm

Type		h_3	h_4	h_5	h_6	h_7	h_8	l	t
RFD 60 G	inch	3.543	1.772	.906	.433	1.772	3.543	5.118	.551
	mm	90	45	23	11	45	90	130	14
RFD 110 G	inch	3.543	1.772	.906	.433	1.772	6.299	5.118	.551
	mm	90	45	23	11	45	160	130	14
RFD 160 G	inch	4.764	2.205	1.102	.433	2.165	5.118	7.087	.669
	mm	121	56	28	11	55	130	180	17
RFD 240 G	inch	4.764	2.205	1.102	.433	2.165	7.480	7.087	.669
	mm	121	56	28	11	55	190	180	17
RFD 330 G	inch	5.433	2.874	.906	.433	3.150	7.087	9.055	.787
	mm	138	73	23	11	80	180	230	20
RFD 660 G	inch	6.890	3.622	.906	.433	3.976	12.598	12.592	.984
	mm	175	92	23	11	100	320	330	25

DIMENSIONS RFD:

RFD 950 F
RFD 1300 F





Top View

Type		$b_1 \pm a^*$	b_2	b_3	b_4	b_5	$\varnothing d_1$	$\varnothing d_2$
RFD 950 F	inch	23.071	10.039	6.220	4.752	2.756	7.874	11.417
	mm	586	255	158	120.7	70	200	290
RFD 1300 F	inch	25.433	10.039	7.008	5.126	3.071	7.874	11.417
	mm	646	255	178	130.2	78	200	290

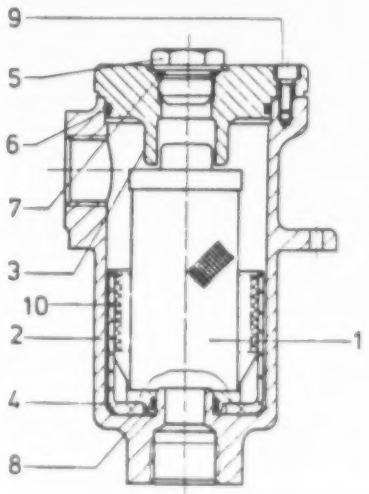
* a = .197 inch = 5 mm

Type		$\varnothing d_3$	$\varnothing d_4$	$\varnothing d_5$	$\varnothing d_6$	h_1	h_2	h_3
RFD 950 F	inch	3.150	.709	6.299	3.543	17.716	9.291	7.008
	mm	80	18	160	90	450	236	178
RFD 1300 F	inch	3.937	.709	3.987	3.937	22.559	12.716	9.055
	mm	100	18	180	100	573	323	230

Type		h_4	h_5	h_6	h_7	h_8	l
RFD 950 F	inch	4.331	1.181	.433	3.937	13.779	12.992
	mm	110	30	11	100	350	330
RFD 1300 F	inch	5.157	.945	.433	4.921	18.110	15.354
	mm	131	24	11	125	460	390

4. SPARE PARTS: RF

Reference:
Proper function is only guaranteed when using HYCON replacement parts.



Item	Description		RF 30	RF 60	RF 110	RF 160	RF 240
1	Element 10 µm Element 20 µm	4 *plus* 4	0030R010V 0030R020V	0060R010V 0060R020V	0110R010V 0110R020V	0160R010V 0160R020V	0240R010V 0240R020V
	Element 25µm Element 74 µm Element 149 µm	Wire Mesh	0030R025W 0030R074W 0030R149W	0060R025W 0060R074W 0060R149W	0110R025W 0110R074W 0110R149W	0160R025W 0160R074W 0160R149W	0240R025W 0240R074W 0240R149W
	Element 10 µm Element 20 µm	Paper	0030R010P 0030R020P	0060R010P 0060R020P	0110R010P 0110R020P	0160R010P 0160R020P	0240R010P 0240R020P
	Element 10 µm Element 20 µm	Betamicron N	0030R010BN 0030R020BN	0060R010BN 0060R020BN	0110R010BN 0110R020BN	0160R010BN 0160R020BN	0240R010BN 0240R020BN
2	Housing		1	1	1	1	1
3	Lid		1	1	1	1	1
4	Contamination Retainer		1	1	1	1	1
5	Plug		1	1	1	1	1
6	O-Ring		1 57.2 x 3	1 59 x 3	1 59 x 3	1 80 x 4	1 80 x 4
7	O-Ring		1 18 x 2.5	1 18 x 2.5	1 18 x 2.5	1 18 x 2.5	1 18 x 2.5
8	O-Ring		1 12.37 x 2.62	1 22 x 3.5	1 22 x 3.5	1 34 x 3.5	1 34 x 3.5
9	Socket Head Cap Screw		–	4 3/16 x 5/8	4 3/16 x 5/8	4 1/4 x 5/8	4 1/4 x 5/8
10	Magnetic Strip (on request)		1	1	1	1	1

Item	Description		RF 330	RF 660	RF 950	RF 1300
1	Element 10 µm Element 20 µm	4 *plus* 4	0330R010V 0330R020V	0660R010V 0660R020V	0950R010V 0950R020V	1300R010V 1300R020V
	Element 25 µm Element 74 µm Element 149 µm	Wire Mesh	0330R025W 0330R074W 0330R149W	0660R025W 0660R074W 0660R149W	0950R025W 0950R074W 0950R149W	1300R025W 1300R074W 1300R149W
	Element 10 µm Element 20 µm	Paper	0330R010P 0330R020P	0660R010P 0660R020P	0950R010P 0950R020P	1300R010P 1300R020P
	Element 10 µm Element 20 µm	Betamicron N	0330R010BN 0330R020BN	0660R010BN 0660R020BN	0950R010BN 0950R020BN	1300R010BN 1300R020BN
2	Housing		1	1	1	1
3	Lid		1	1	1	1
4	Contamination Retainer		1	1	1	1
5	Plug		1	1	1	1
6	O-Ring		1 105 x 5	1 142 x 6	1 175 x 5	1 175 x 5
7	O-Ring		1 18 x 2.5	1 18 x 2.5	1 18 x 2.5	1 18 x 2.5
8	O-Ring		1 48 x 3	1 68 x 5	1 96 x 6	1 96 x 6
9	Socket Head Cap Screw		4 5/16 x 5/8	4 1/2 x 3/4	4 5/8 x 1 1/4	4 5/8 x 1 1/4
10	Magnetic Strip (on request)		1	1	1	1

O-Ring dimensions in millimeters

REXROTH
BETHLEHEM, PA 18018

ENGINEERING DATA SHEET

DIRECTIONAL CONTROL VALVE
WE 10 (1/2") A.C. Sol.

Solenoid Direct Operated ..Subplate Mounting

Mounting to ANSI D02	5000 PSI (340 bar)	26 GPM (100 l/min)

RA
RA 23332
ISSUED 8-1-79
REVISED 3-81

Type 4 WE 10 .. 10/L W 220-50 NDL

4 WE 10 .. 10/L W 220-50NZ4

4 WE 10 .. 10/L W 220-50NZ5

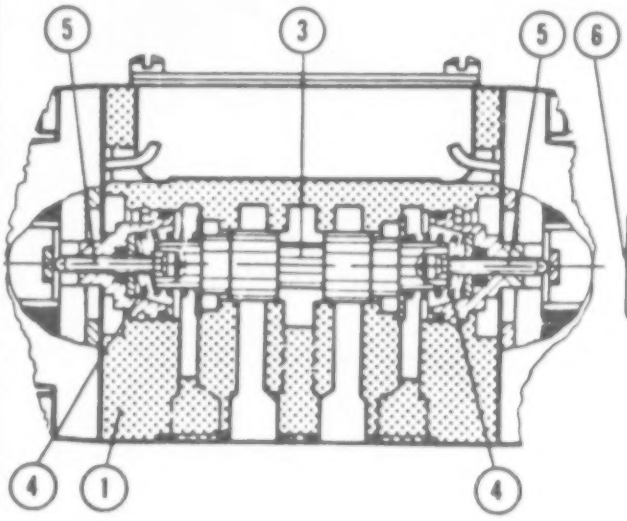
4 WE 10 .. 10/L W 220-50NDZL

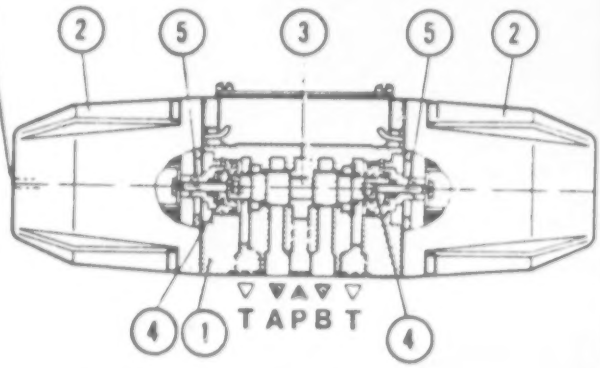
- *Direct operating directional spool valve, solenoid operated*
- *AC air gap solenoids*
- *Available with or without manual solenoid override*
- *Electrical connection as single or central connection*
- *Complete range of spools available*

DESCRIPTION OF FUNCTION, SECTION VIEW

GENERAL DESCRIPTION...*The 4-way directional control valve is used in a hydraulic circuit to control the direction of motion of a hydraulic cylinder or motor. The command signal is electric. The WE 10 valve is direct acting, in that the solenoid (2) forces act directly on the spool (3) through a push pin (5). Three position valves, in addition to controlling forward and reverse motion, have a center or neutral position. The flow configuration in the center position is determined by the spool selected. This center position is achieved when the solenoids are de-energized. Centering springs (4) center the spool (3) in the valve body (1).*

Pushbutton manual overrides (6) allow the manual operation of the valve in the absence of electrical power. Indicator lights are wired parallel to the solenoid to indicate the electric signal to the solenoid. Indicator lights are an Optional Feature.



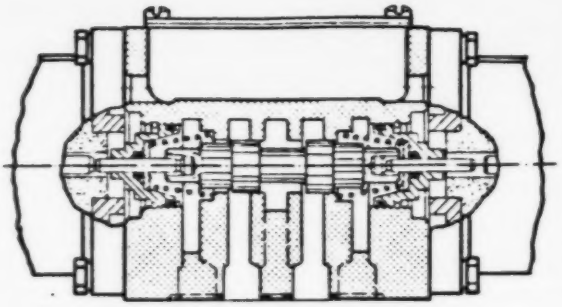


1. *Valve Body*
2. *Solenoid*
3. *Spool*
4. *Centering Spring*
5. *Push Pin*
6. *Manual Override (one ea. end)*

OPTIONAL FEATURE "O" Without Springs

The double solenoid, two position option without spool centering springs, is available with spools "C" and "D" only. This no spring version is used for high cycling applications.

As there are no springs in this valve, it is recommended that the solenoid be continuously energized and that the valve is mounted horizontally; this prevents spool drift.

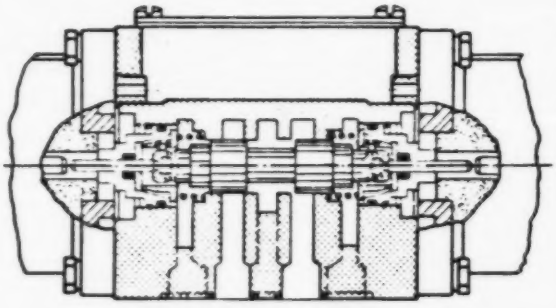


Type 4 WE 10 D 10/LO ..

OPTIONAL FEATURE "OF" Detented and Without Springs

This optional feature is a detented version of the double solenoid, two position option without spool centering springs. It is available with spools "C" and "D" only. The detented version is used in low cycling applications which greatly extends the life of the solenoid. The solenoid requires a short time cycle as the spool will hold its position when the detent is in place. Positioning of the spool requires approximately a time cycle of 100 MS.

As the spool position is held by the detent, continuous energizing of the solenoid is not necessary and the mounting position of the valve is optional.



Type 4 WE 10 D 10/LOF ..

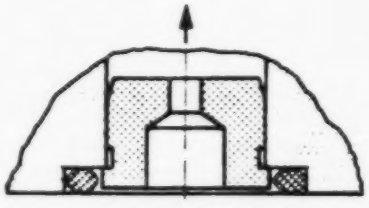
OPTIONAL FEATURE "B" Throttle Orifice Insert

In applications where high flows are encountered from the pump or accumulators systems, flows could exceed the allowable flow for the valve. Excess flows can cause valve malfunctions and overloading of the solenoid, or the springs will not return the spool for the next cycle.

To avoid valve malfunctions, due to excess flows, three orifice sizes are available and mounted in the valve's pressure port.

Available Orifices

Ordering Code B08 Orifice Diameter 0.031" (0.8mm)
Ordering Code B10 Orifice Diameter 0.039" (1.0mm)
Ordering Code B13 Orifice Diameter 0.047" (1.2mm)



Type 4 WE 10 .. 10/L .. B ..

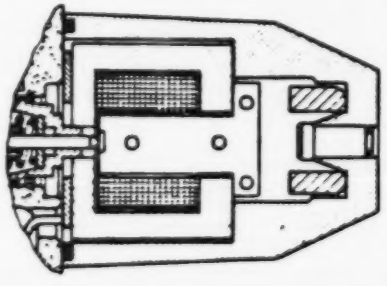
SOLENOIDS

Solenoids used for the WE 10 Design - Series 10 valves are air gap solenoids and operated with A.C. electrical power.

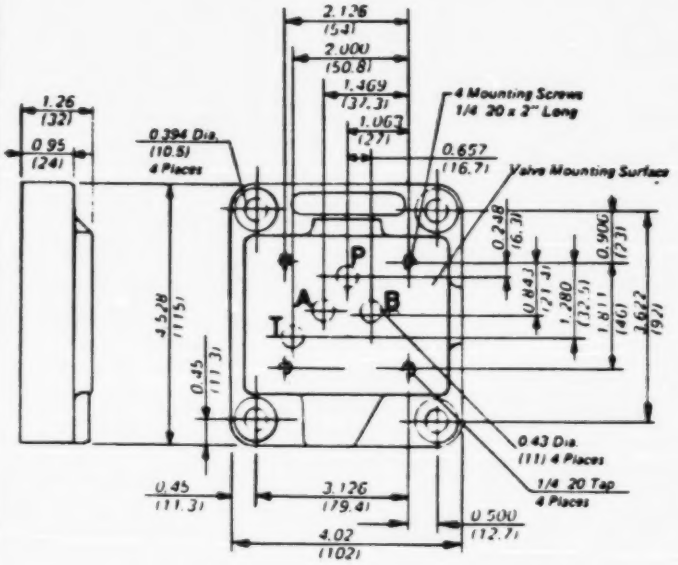
This solenoid is suited for operation in most atmospheres as it is fully encapsulated and treated against funguses. This provides protection and assures long service life. A seal is provided between the valve body and the solenoid housing. The manual override has an O-ring seal.

Electrical connections are made through the valve body to a terminal strip. As an optional feature, plug-in connections are available.

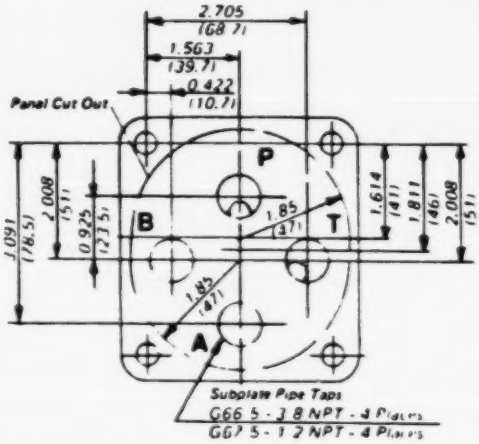
- *Fast response - 30 MS.*
- *No special electrical contact protection required at the relay or pushbutton.*
- *Fully encapsulated to prevent entry of foreign materials.*

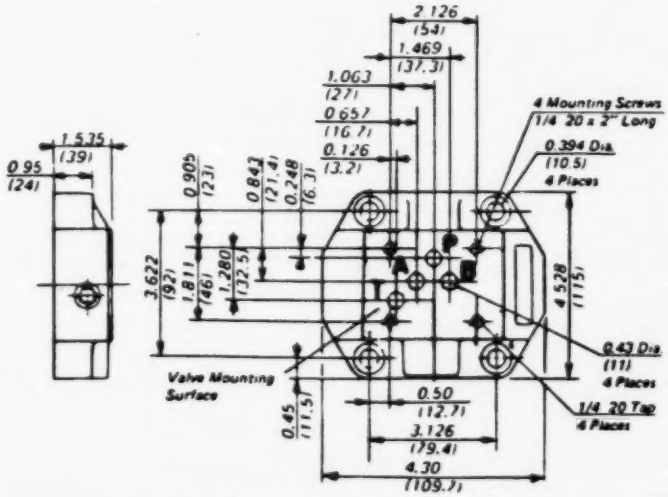


SUBPLATE (Valve Mounting Surface) G66/5

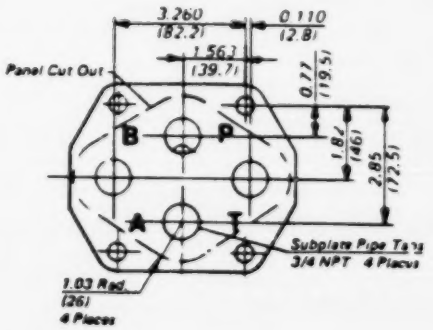


SUBPLATE (Piping Connections) G66/5 (3/8" NPT) and G67/5 (1/2" NPT)

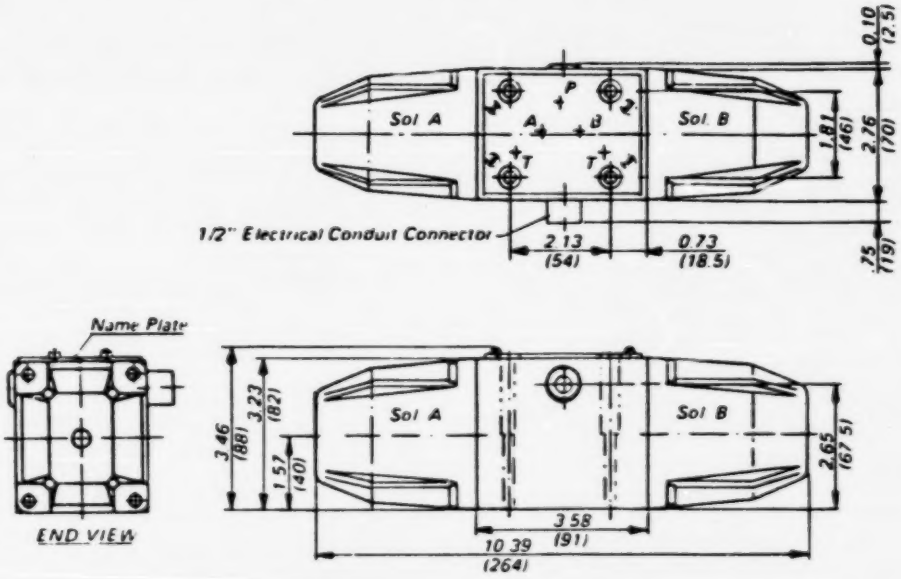




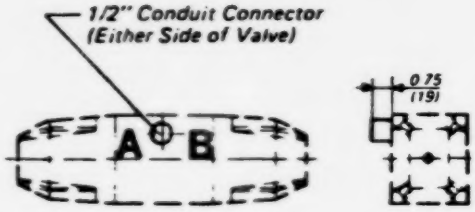
SUBPLATE (Piping Connections) G501/5 (3/4" NPT)



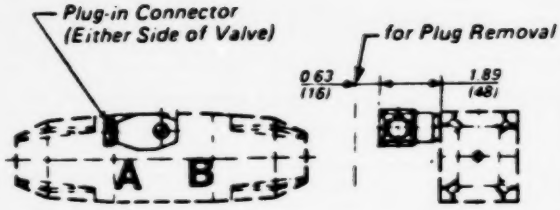
DOUBLE AND SINGLE A.C. AIR GAP SOLENOID VALVE
(Standard)



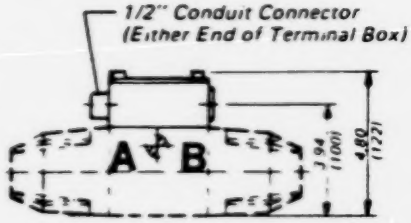
STANDARD Electrical Connection in Valve Body
ORDERING CODE "Omit" for Standard Connections



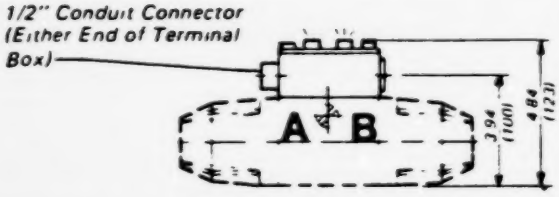
OPTIONAL FEATURE - Electrical Plug-in
ORDERING CODE "Z"



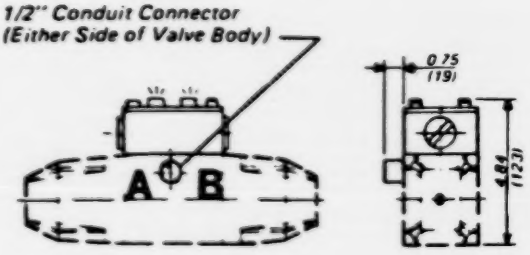
OPTIONAL FEATURE -
Electrical Connection in Top Terminal Box
ORDERING CODE "D"



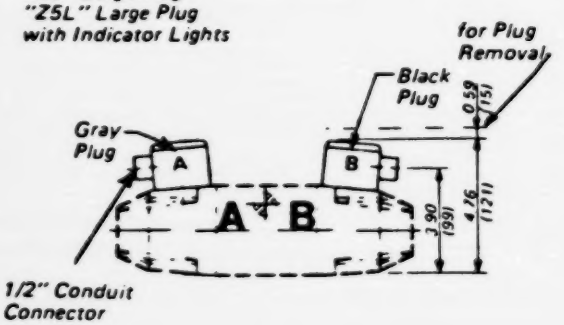
OPTIONAL FEATURE - Electrical Connections & Pilot Lights in Top Terminal Box
ORDERING CODE "DL"



OPTIONAL FEATURE -
Electrical Connection in Valve Body Top Terminal Box with Lights
ORDERING CODE "L"



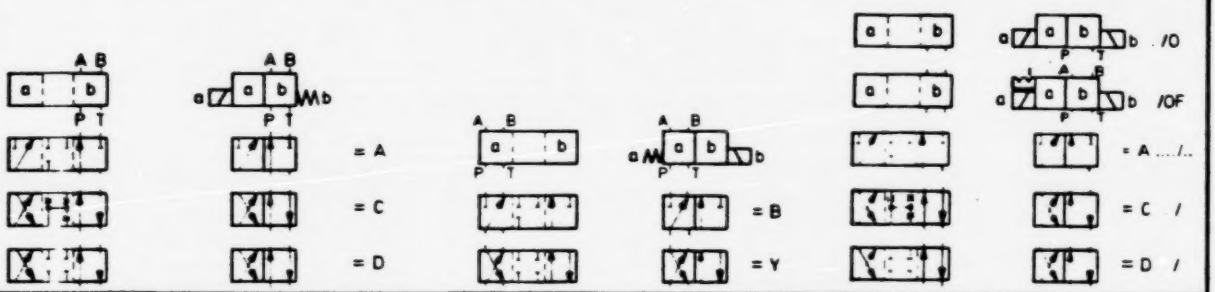
OPTIONAL FEATURE - Large Electrical Plug-in On The Solenoid
ORDERING CODE:
"Z5" Large Plug
"Z5L" Large Plug with Indicator Lights

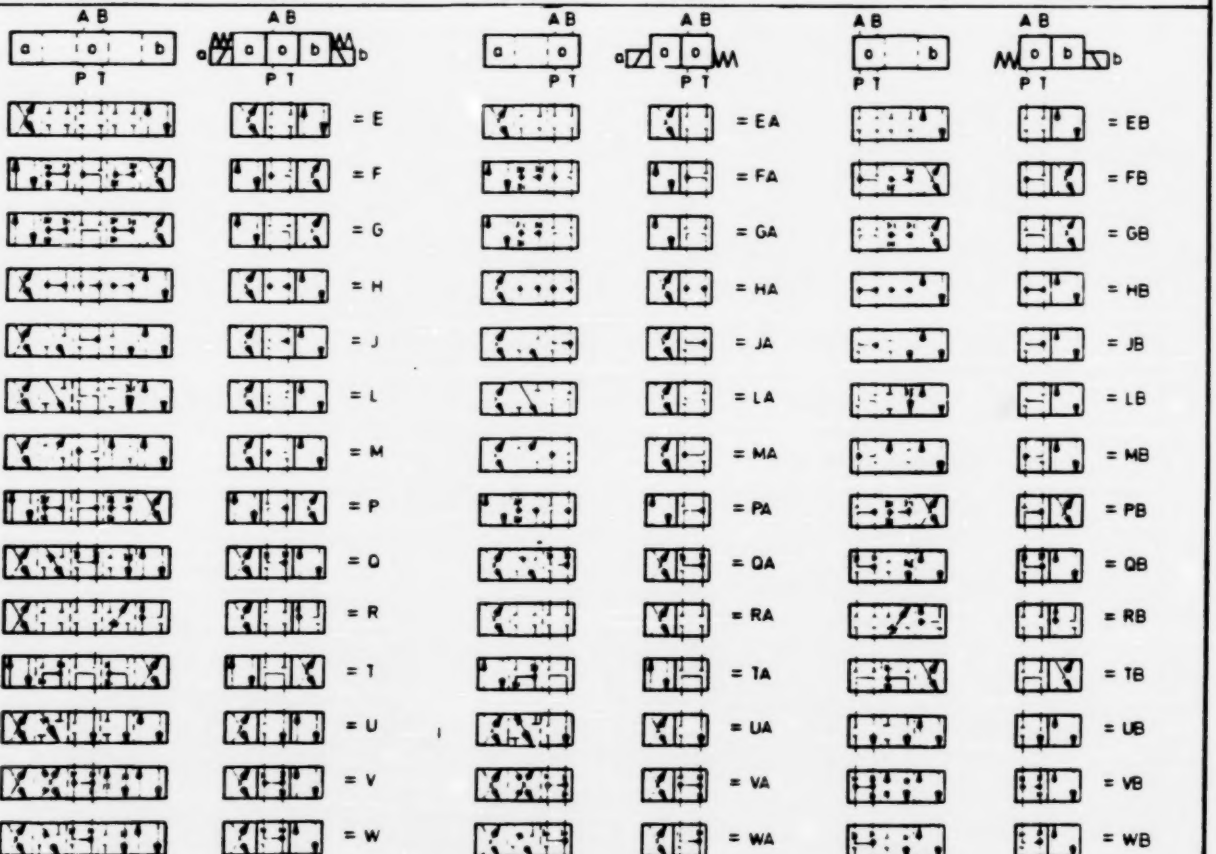


ORDERING CODE RA 23332

4 WE 10 C 10/OF L W220-50 N DL B08 V/5

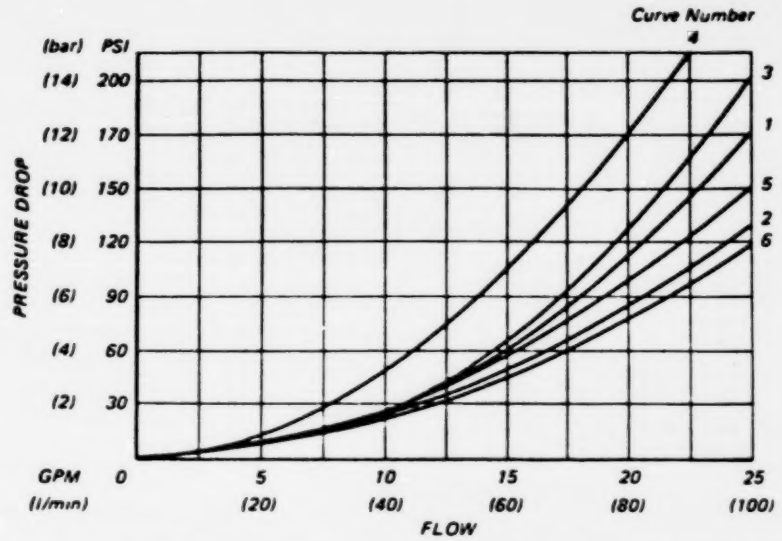
- NO. OF WORKING PORTS
  - 3 = 3 way
  - 4 = 4 way
- OPERATOR
  - E = Solenoid
- SIZE
  - 10 = 1/2"
- SPOOL
  - See chart below
- DESIGN SERIES
- RETURN OPERATOR
  - O = Without spring return, w/o detent
  - OF = Without spring return, with detent
- SOLENOIDS
  - L = Air gap
  - A = Wet pin
- SEALS
  - Omit = Buna-N
  - V = Viton
- OMIT = Without cartridge throttle
- B08 = Throttle dia. 0.8 mm
- B10 = Throttle dia. 1.0 mm
- B12 = Throttle dia. 1.2 mm
- ELECTRICAL CONNECTORS
  - Refer to Page 5
- MANUAL OVERRIDE
  - Omit = Not required
  - N = With manual override
- VOLTAGES
  - Omit = 120-60 AC
  - W + voltage + frequency for all AC
  - G + voltage for all DC





PRESSURE BASED ON FLOW Test Fluids 172 SSU (36cSt) at 120°F (50°C) **RA 23332**

Curve No. 4 for "R" Spool - Ports A-B with Solenoid B Energized
Curve No. 4 for "G" Spool - Ports P-T Spool in Center Position



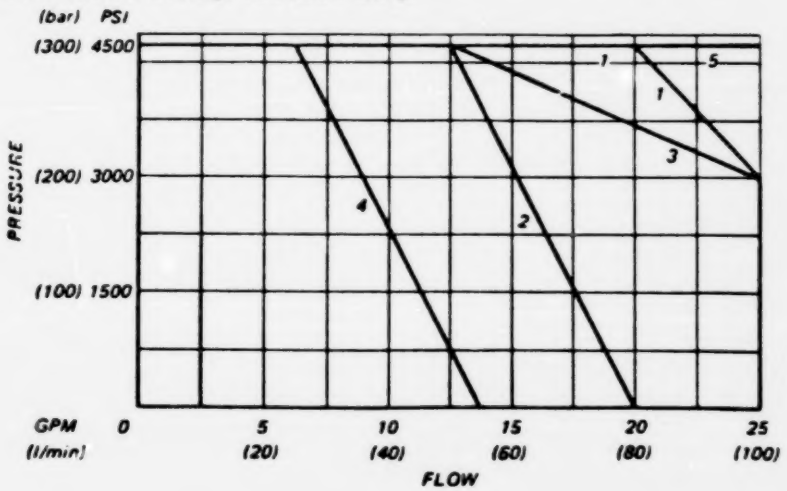
CURVE SELECTION CHART

Spool Type	Flow Direction P-A	P-B	A-T	B-T
A	1	1		
B	1	1		
C	3	3	2	2
D	3	3	2	2
E	1	1	2	2
F	1	1	2	2
G	5	5	3	3
H	1	1	2	2
J	1	1	6	6
L	3	1	6	2
M	1	1	2	2
P	1	1	2	2
Q	1	1	2	2
R	3	3	2	
T	5	5	3	3
U	3	1	6	2
V	1	1	2	2
W	1	1	2	2
Y	3	3	2	2

NOTE: To maintain optimum efficiency and trouble free spool shifting, it is recommended to use a full flow filtration of 25 microns or less. This filtration will avoid silting in the flow passages which could limit the maximum flow capacity of the valve. Flow data as shown applies to two directional flows. If only one flow direction, as in the case when Port A or B is plugged, the flow is reduced from that as shown.

VALVE PERFORMANCE DATA

Flow based on pressure tests made with warm oil and the solenoid voltage 10% below rating.



CURVE SELECTION CHART

Performance Curve	Spool Types
1	C,D,E H,L,V, Y
2	F,G,P, R,T
3	J,M,Q, U,W
4	A,B
5	C/O, D/O

HYDRAULIC DATA

Operating Pressure Port A, B, P PSI	5000 PSI (315 bar)	
Port T PSI	2300 PSI (160 bar)	
With spool Types A and B, Port T must be used as drain port, when operating pressure is in excess of 2300 PSI (160 bar)		
Flow	Up to 26 GPM (100 l/min)	
Flow Section (Switching Position O)	Spool Type O 6% of Nominal Section	Spool Type W 3% of Nominal Section
Hydraulic Medium	Petroleum Based Hydraulic Fluids	
Fluid Temperature Range	-20°F (-30°C) to +160°F (+70°C)	
Viscosity Range	35 SSU (2.8cSt) to 1750 SSU (380cSt)	
Weight Valve With 1 Solenoid	8.4 lbs. (3.8 kg)	
Valve With 2 Solenoids	10.6 lbs. (4.8 kg)	
Subplates	3/8" NPT 5 lbs. (2.3 kg)	
	1/2" NPT 5 lbs. (2.3 kg)	
	3/4" NPT 6 lbs. (2.7 kg)	

ELECTRICAL DATA

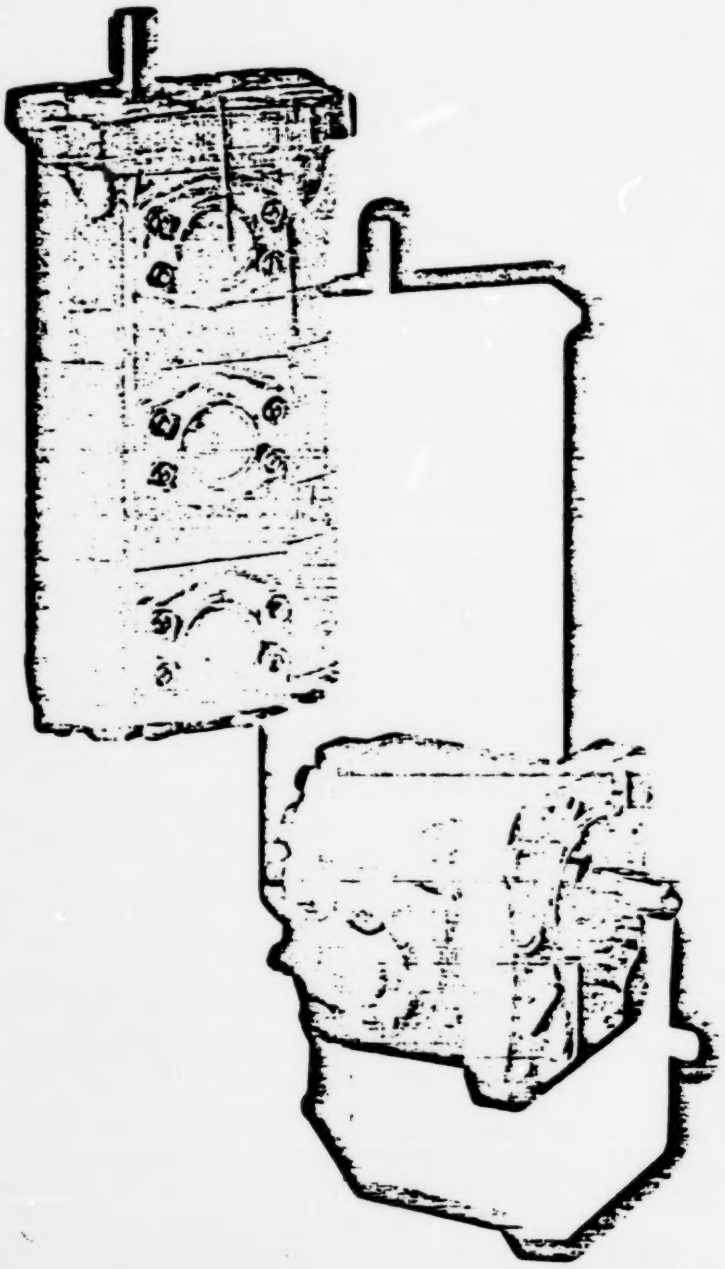
Voltages Available	42, 110, 127, 220 (with 50 Hz); 120, 220 (with 60 Hz)
Holding Current	64 VA
In-rush Current	430 VA
Duty Cycle	DB
Switching Time, On	30 Milliseconds
Switching Time, Off	30 Milliseconds
Ambient Temperature	+120°F (+50°C)
Coil Temperature	+300°F (+150°C)
Switching Frequency	7200 Cycles p/hr.

For application to other specifications, please consult us.

FRANÇAIS

de pompes et moteurs hydrauliques à engrenage à très hautes performances

→ DIVISEUR DE DEBIT



* **POMPES A ENGRENAGE**
  31 modèles en 4 séries
  capacités : 1 à 250 cm^3/t

* **POMPES MULTICORPS**
  500 combinaisons de pompes double corps. Des milliers de combinaisons en version pompes triples et quadruples corps

* **POMPES AVEC MULTIPLICATEURS**
  pour prise de force sur tracteur

* **MOTEURS HYDRAULIQUES A ENGRENAGE**
  - RAPIDES - 31 modèles capacité 1 à 250 cm^3/t
  - SEMI-RAPIDES - 16 à 1000 cm^3/t
  - LENTS - 85 à 2880 cm^3/t
  - TRÈS LENTS - 1000 à 5300 cm^3/t

* **GROUPES ÉLECTRO-POMPES**
  courant alternatif 0,5 à 100 kW

* **GROUPES ÉLECTRO-POMPES**
  courant continu 12 - 24 - 36 - 48 volts
  unités complètes pour équipements mobiles

* **VALVES HYDROSTATIQUES**
  débit 5 à 70 l/mn - 30 à 160 l/mn - 100 à 320 l/mn

* **CLAPETS ANTI-RETOUR**
  débit 10 à 350 l/mn

* **TÊTE DE FILTRATION**
  débit 5 à 90 l/mn

* **CRÉPINES D'ASPIRATION**
  débit 1 à 500 l/mn

* **RÉSERVOIRS POUR CIRCUITS HYDRAULIQUES**
  capacité 7 - 10 - 20 - 30 - 40 - 80 litres

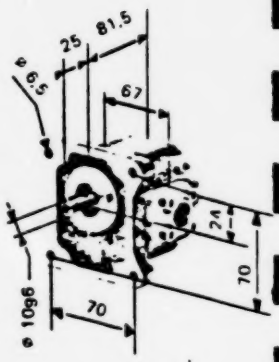
HYDROPERFECT-INTERNATIONAL
26. Rue Condorcet - Z. I. 94430 CHENNEVIÈRES - Tél. 933 60-22 - Télex 691910 F

POMPES

MOTEURS

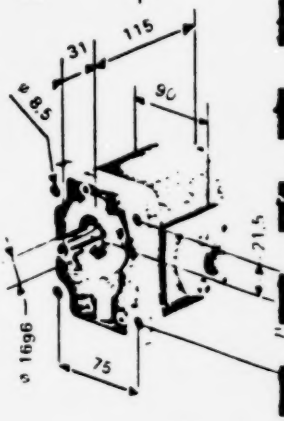
SERIE 1

MODELE	CAPACITE CM³/T	PRESSION (BARS) ECO	PRESSION (BARS) SAPHIR	VITESSE (T/MN) MINI	VITESSE (T/MN) MAXI	DEBIT L/MN A 1500 T/MN	MASSE KG	VITESSE T/MN MINI	VITESSE T/MN MAXI	PRESSION MAXI	COUPLE MdaN 100 BARS
1801	1	250	400	1 200	8 000	1.5	0.9	1 200	8 000	200	0.10
1802	2	250	400	1 000	8 000	3	0.9	1 000	8 000	200	0.24
1803	3	250	400	1 000	7 000	4.5	0.9	1 000	7 000	200	0.37
1804	4	200	300	800	8 000	6	1.1	800	8 000	175	0.53
1805	5	175	250	500	8 000	7.5	1.1	500	8 000	150	0.71
1806	6	175	200	500	5 000	9	1.1	400	5 000	150	0.85



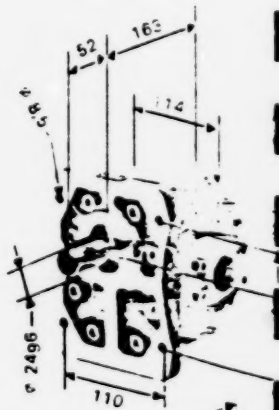
SERIE 2

2804	4	250	300	1 000	3 500	6	1.6	300	4 000	200	0.53
2806	6	250	300	1 000	3 500	9	1.6	300	4 000	200	0.85
2808	8	250	300	1 000	3 500	12	1.7	300	4 000	200	1.14
2812	12	250	300	800	3 500	17.3	1.8	250	4 000	200	1.75
2815	15	225	250	500	3 500	22.5	2.1	250	3 500	200	2.22
2818	18	200	225	500	3 500	27	2.2	200	3 500	175	2.68
2822	22	160	200	500	3 500	33	2.3	200	3 500	150	3.22
2826	26	150	175	500	3 000	39	2.7	200	3 000	150	3.85
2830	30	150	175	500	3 000	45	2.8	200	3 000	150	4.44



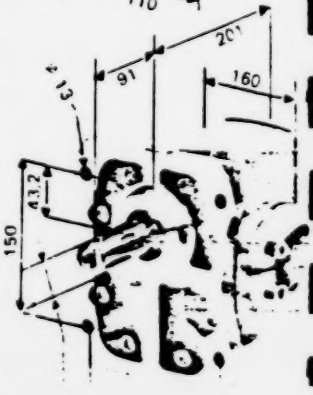
SERIE 3

3820	20	250	300	800	3 000	30	5.8	300	3 500	200	2.86
3825	25	250	300	800	3 000	37.5	5.8	300	3 500	200	3.62
3831	31	225	250	500	3 000	46.5	5.8	300	3 000	200	4.48
3840	40	225	250	500	3 000	60	6.7	250	3 000	200	5.85
3850	50	225	250	500	3 000	75	6.9	250	3 000	200	7.32
3860	60	175	225	500	2 500	90	7	200	3 000	175	8.88
3871	71	150	175	500	2 500	106.5	7	200	2 500	150	10.63
3880	80	125	150	500	2 500	120	7.1	200	2 500	125	11.98
3890	90	125	150	500	2 000	135	7.8	200	2 000	125	13.20
3100	100	125	150	500	2 000	150	8	200	2 000	125	14.25



SERIE 4

4075	75	200		500	2 500	112.5	17	300	2 500	200	11
4110	112	200		500	2 500	168	17.2	300	2 500	200	16.5
4150	150	200		500	2 500	225	17.4	250	2 500	200	22
4175	175	175		400	2 500	262.5	18	250	2 500	175	26
									2 500	150	32



Fluidtechnische Geräte GmbH
Justus-von-Liebig-Straße
D-6603 Sulzbach/Saar
Telefon (06897) 3081 und 3082
Telex 04-429345 flut

FLUTEC HOSE BREAK VALVES

1. DESCRIPTION

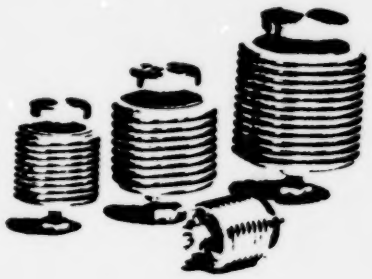
FLUTEC Hose Break Valves are used to eliminate uncontrollable movements of the actuator; for example in hose breaks of dead weight cylinders. These are volume-limiting flat seat valves. The valve poppet is normally kept open by a spring, which is designed so that the force of the spring is greater during normal operation than the force on the valve poppet created by the flow.

The valve stays open, and the flow can move in either direction. Automatic shut-off occurs if the flow resistance force on the poppet exceeds the level set on the valve. The valve opens automatically by pressurizing connection A. Depending on the pressure P_b, the leakage rate on the cartridge valve threads (RBE...) amounts to approximate 0-100 cc./min. If the actuator drops slowly, the valve threads can be sealed into the cartridge and made leakfree. The closing flow rate is adjustable at the valve.

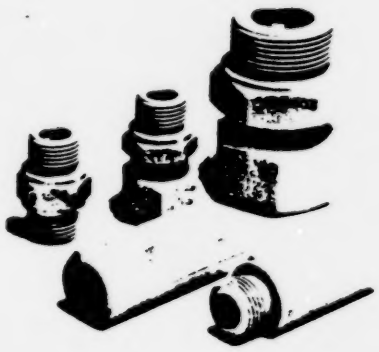
Valves are installed between actuator and possible line breakage point:

1. By screwing cartridge unit directly into the connection hole of the cylinders.

2. By installing housing valve directly into the cylinder port connection.



Type RBE...
Cartridge Unit



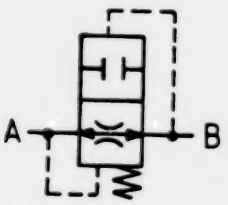
Type RB...
Housing Valve

2. TECHNICAL DATA

2.1. GENERAL

2.1.1. **Hydraulic Symbol**
Hose Break Valves

B ... Fusing end of valve
A-B ... Free flow
B-A ... Operating direction, valve closes if flow rate exceeds adjustment.



2.1.2. Type Code
(also ordering example)

RB E - 7/16-20 - 0 - 50

Hose Break Valves

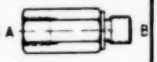
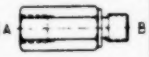
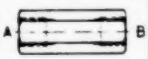
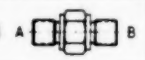
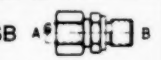
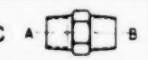
Type of Connection
See 2.1.3.

Size of Connection
See 2.1.3.

Modification Number

Closing Flow
See 2.1.3.

2.1.3. Table and Type Code

Type of Connection			Size of Connection				
Code Letter	Connection A	Connection B					
E	Cartridge – SAE		SAE 7/16-20	SAE 9/16-18	SAE 3/4-16	SAE 1 1/16-12	Cartridge
E	Cartridge – R		R 1/4"	R 3/8"	R 1/2"	R 3/4"	
XB 	SAE J 514	SAE J 514	SAE 7/16-20	SAE 9/16-18	SAE 3/4-16	SAE 1 1/16-12	Housing valve Above listed cartridge is built-in
XB 	Bore Hole X Pattern DIN 3852	Bore Plug with seal lip, B Pattern DIN 3852	R 1/4"	R 3/8"	R 1/2"	R 3/4"	
XX 	Bore Hole X Pattern, DIN 3852		R 1/4"	R 3/8"	R 1/2"	R 3/4"	
BB 	Bore Plug with seal B Pattern, DIN 3852		R 1/2"	R 3/4"	R 1"	R 1 1/4"	
SB 	Threaded Cut-ring S series heavy duty DIN 2353	Bore Plug with seal lip, B Pattern DIN 3852	R 1/2"	R 3/4"	R 1"	R 1 1/4"	
CC 	Bore plug with U.S. standard thread NPTF		1/2 NPTF	3/4 NPTF	1 NPTF	1 1/4 NPTF	

Closed Flow Rate Q_A	(GPM) (l/min)	.8-6.6 3-25	1.6-13.2 6-50	3.2-19.8 12-75	6.6-39.6 25-150

To avoid the activation of hose break valves on flow surges, the closing flow rate should be at least 20% above the normal flow rate.

The valves for standard production are shipped with max. flow rates. Settings are optional. See curves under 2.2.4. If the factory is to set the flow rates, this should be indicated when ordering, (GPM) – (l/min).

2.1.4. **Design**
Flat Seat Valve

2.1.5. **Mounting Method**
RBE . . . Cartridge
RB . . . Housing Valve for inline installation

2.1.6. **Approximate Weights**

RBE
SAE 7/16-20
R 1/4" .02 lbs - 9 g
SAE 9/16-18
R 3/8" .04 lbs - 16 g
SAE 3/4 -16
R 1/2" .07 lbs - 31 g
SAE 1 1/16-12
R 3/4" .13 lbs - 57 g

RBXB
SAE 7/16-20
R 1/4" .17 lbs - 77 g
SAE 9/16-18
R 3/8" .25 lbs - 110 g
SAE 3/4 -16
R 1/2" .43 lbs - 195 g
SAE 1 1/16-12
R 3/4" .89 lbs - 400 g

RBXX
R 1/4" .19 lbs - 83 g
R 3/8" .26 lbs - 116 g
R 1/2" .47 lbs - 210 g
R 3/4" .93 lbs - 420 g

RBBB
R 1/2" .24 lbs - 105 g
R 3/4" .24 lbs - 180 g
R 1 " .72 lbs - 325 g
R 1 1/4" 1.3 lbs - 595 g

RBSB
R 1/2" .21 lbs - 95 g
R 3/4" .38 lbs - 170 g
R 1 " .68 lbs - 305 g
R 1 1/4" 1.13 lbs - 510 g

RBCC
1/2 NPTF .21 lbs - 97 g
3/4 NPTF .35 lbs - 155 g
1 NPTF .64 lbs - 290 g
1 1/4 NPTF 1.12 lbs - 505 g

2.1.7. **Mounting Position**
Optional

2.1.8. **Direction of Flow**
A-B . . . free Flow
B-A . . . free Flow
valve automatically closes if flow exceeds set level.

2.1.9. **Flow Media**
Mineral Oil in accordance with DIN 51525 and DIN 51525.
Consult Factory for other media.

2.2. HYDRAULIC DATA

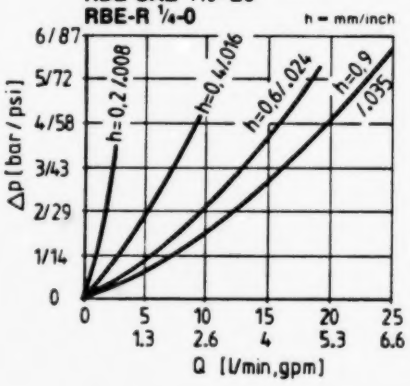
2.2.1. **Operating Pressure**
p max. pressure 5000 PSI
= 350 BAR
p min. pressure 145 PSI
= 10 BAR

2.2.2. **Temperature Range**
min . . . max . . .
+ 4° F . . . + 176° F
− 20° C . . . + 80° C

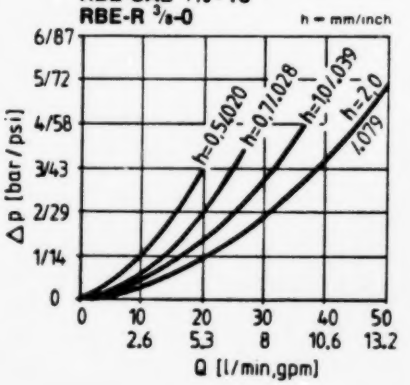
2.2.3. **Nominal Flow Rate**
Pressure differential in Δp dependent on Flow Q at different operating levels "h" (mm/inch.) measured at 168 SSU, t_{oil} = 122° F = 50° C.

The curves are valid for cartridges RBE . . . and for housing valves RB . . . in accordance with table 2.1.3. for both flow directions. The limit line indicates the maximum closing flow rates dependent on "h" for both flow directions.

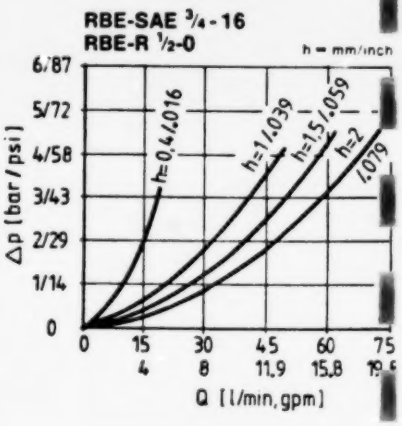
RBE-SAE 7/16-20
RBE-R 1/4-0



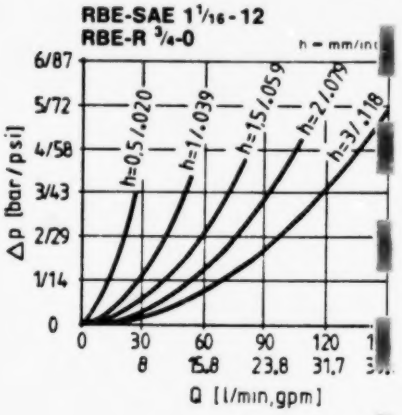
RBE-SAE 9/16-18
RBE-R 3/8-0



RBE-SAE 3/4-16
RBE-R 1/2-0



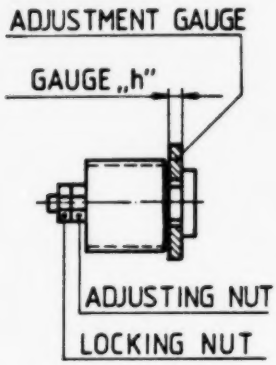
RBE-SAE 1 1/16-12
RBE-R 3/4-0



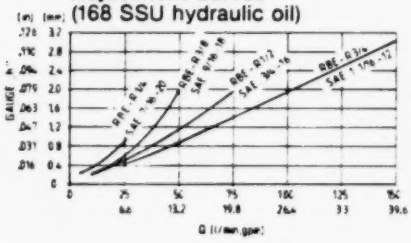
2.2.4. **Adjustment Curves for Closing Flow Rates – Setting**

The size of the closing flow rate is dependent on the dimension "h". After loosening the lock nut, set the adjustment with a thickness gauge to the proper setting. The lock nut must be tightened for safety.

Adjustment Curves
(168 SSU hydraulic oil)



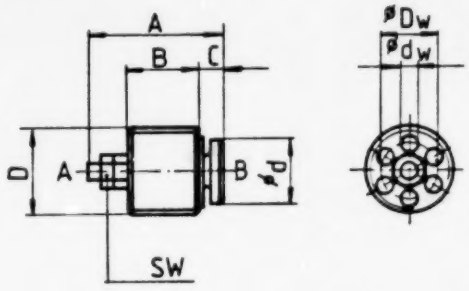
Adjustment Curves
(168 SSU hydraulic oil)



The adjustment curves are valid for cartridge RBE . . . and for all housing valves RB . . . and cartridge RBE in accordance with table 2.1.3.

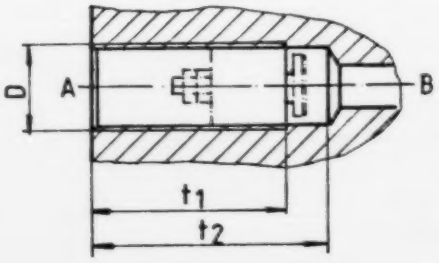
For model RB the cartridge must be removed from the housing for adjustment. See special tool for installation and removal under section 3.

3. DIMENSIONS



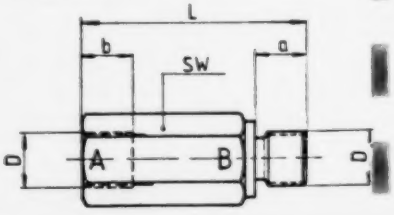
Cartridge

Type		D	A	B	C	Ød	SW	ØDw	Ød
RBE-SAE 7/16-20	inch	7/16-20	.866	.453	.138	.374	5 mm	.315	.098/.197
RBE-R 1/4-0-...	mm	R1/4"	22	11.5	3.5	9.5	5	8	2.5/5
RBE-SAE 9/16-18	inch	9/16-18	1.063	.531	.197	.472	5.5 mm	.394	.138/.236
RBE-R 3/8-0-...	mm	R3/8"	27	13.5	5	12	5.5	10	3.5/6
RBE-SAE 3/4-16	inch	3/4-16	1.299	.669	.217	.551	5/16	.472	.177/.315
RBE-R 1/2-0-...	mm	R1/2"	33	17	5.5	14	7	12	4.5/8
RBE-SAE 1 1/16-12	inch	1 1/16-12	1.614	.925	.256	.709	5/16	.630	.256/.354
RBE-R 3/4-0-...	mm	R3/4"	41	23.5	6.5	18	7	16	6.5/9



Housing Valves

RBXB SAE
RBXB - R . . . - 0 - . . .



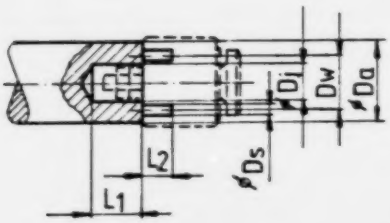
Bore for Cartridge

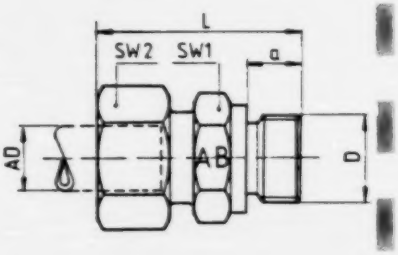
Type		D	t_1	t_2
RBE-SAE $^{7}/_{16}$-20	inch	$^{7}/_{16}$-20	1.260	1.496
RBE-R $^{1}/_{4}$-0-...	mm	R$^{1}/_{4}$"	32	38
RBE-SAE $^{9}/_{16}$-18	inch	$^{9}/_{16}$-18	1.417	1.732
RBE-R $^{3}/_{8}$-0-...	mm	R$^{3}/_{8}$"	36	44
RBE-SAE $^{3}/_{4}$-16	inch	$^{3}/_{4}$-16	1.732	2.087
RBE-R $^{1}/_{2}$-0-...	mm	R$^{1}/_{2}$"	44	53
RBE-SAE 1$^{1}/_{16}$-12	inch	$^{1}/_{16}$-12	2.008	2.402
RBE-R $^{3}/_{4}$-0-...	mm	R$^{3}/_{4}$"	51	61

D		L	a	b	S
$^{7}/_{16}$-20	inch	2.126	.472	.472	$^{3}/_{4}$
R $^{1}/_{4}$"	mm	54	12	12	19
$^{9}/_{16}$-18	inch	2.362	.472	.472	
R $^{3}/_{8}$"	mm	60	12	12	2
$^{3}/_{4}$-16	inch	2.835	.551	.551	1$^{1}/_{16}$
R $^{1}/_{2}$"	mm	72	14	14	2
1$^{1}/_{16}$-12	inch	3.228	.630	.630	1$^{7}/_{8}$
R $^{3}/_{4}$"	mm	82	16	16	36

The values given in the tables are minimum values only.

RBSB - R . . . - 0 - . . .



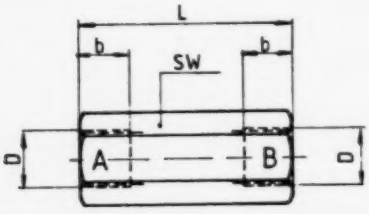


Tools for Installations

Type		Da_{max}	Dw	Di	Ds	L_{1min}	L_{2max}
RBE-R $^{1}/_{4}$-0-...	mm	11.5	8	5.8	2	9	5
RBE-R $^{3}/_{8}$-0-...	mm	15	10	6.5	3	9	6
RBE-R $^{1}/_{2}$-0-...	mm	18	12	8.2	3.5	11	8
RBE-R $^{3}/_{4}$-0-...	mm	24	16	8.5	6	12	8

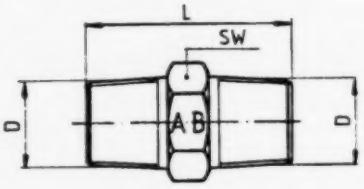
D		L	a	AD	SW_1	SW
R $^{1}/_{2}$"	mm	50	14	16	27	30
R $^{3}/_{4}$"	mm	58	16	20	32	36
R 1"	mm	65	18	25	41	46
R 1$^{1}/_{4}$"	mm	73	20	30	50	50

RBXX - R . . . - 0 - . . .



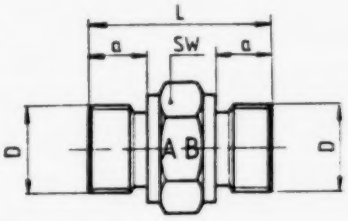
D		L	b	SW
R 1/4"	mm	52	12	19
R 3/8"	mm	60	12	22
R 1/2"	mm	68	14	27
R 3/4"	mm	78	16	36

RBCC - . . . NPTF - 0 - . . .



D		L	SW
1/2 NPTF	inch	1.968	1
1/2 NPTF	mm	50	24
3/4 NPTF	inch	1.968	1 1/4
3/4 NPTF	mm	50	30
1 NPTF	inch	2.362	1 7/16
1 NPTF	mm	60	36
1 1/4 NPTF	inch	2.441	1 13/16
1 1/4 NPTF	mm	62	46

RBBB - R . . . - 0 - . . .



D		L	a	SW
R 1/2"	mm	45	14	27
R 3/4"	mm	50	16	32
R 1"	mm	56	18	41
R 1 1/4"	mm	65	20	50

Catalog A 5174 0/10 82

Dimensions are for general information only. Due to constant development and updating of technical details, we ask that all critical dimensions be made by requesting a certified print.

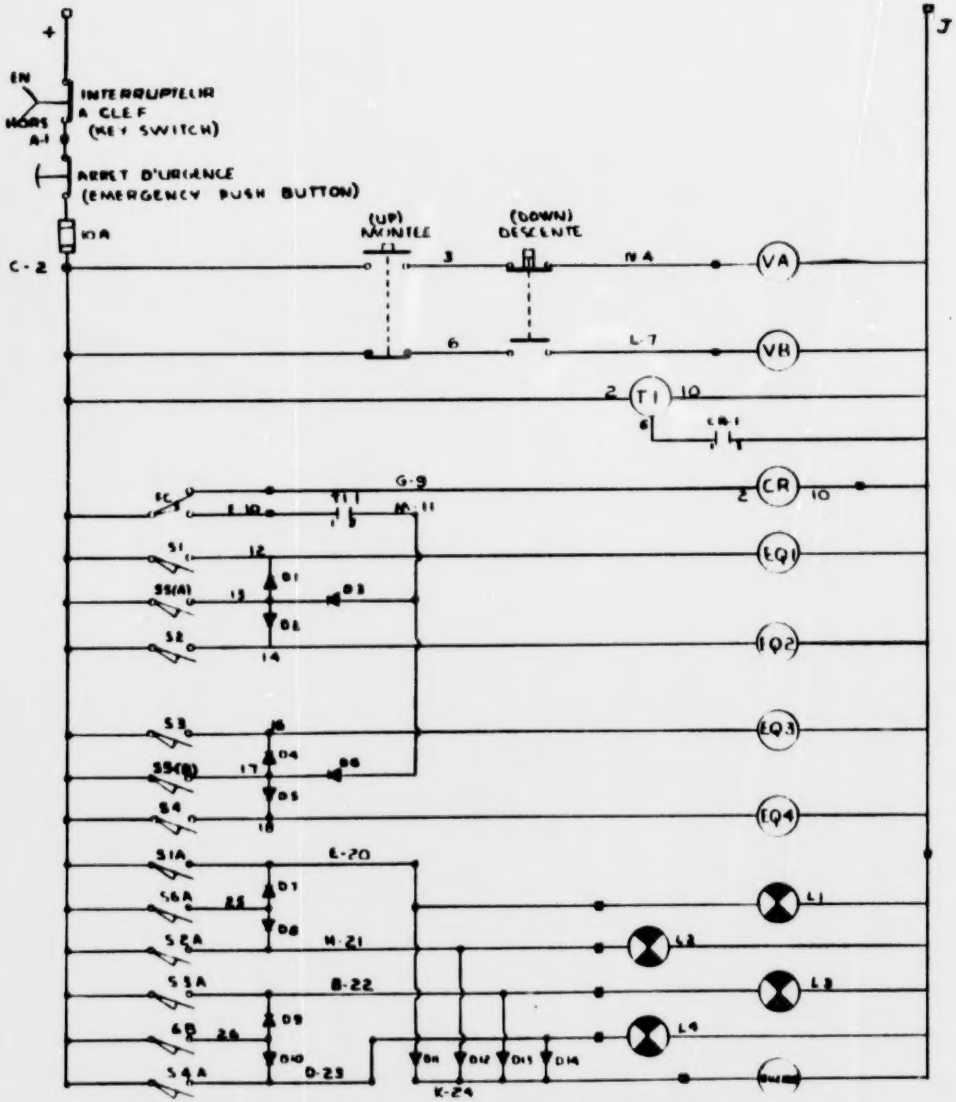
Fluidtechnische Geräte GmbH
Justus-von-Liebig-Straße
D-6603 Sulzbach/Saar
Telefon (06897) 3081 und 3082
Telex 04-429345 flut

ANNEXE B

Système électrique

- Schéma de principe
- Schéma de câblage
- Liste des pièces
- Spécifications techniques

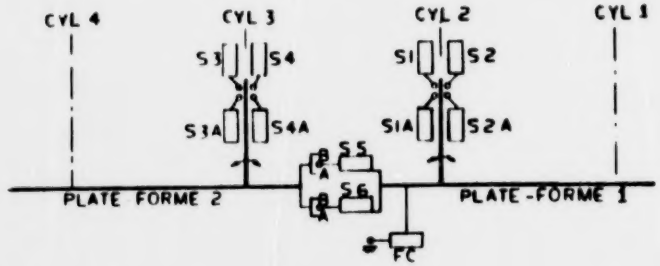
CRIQ

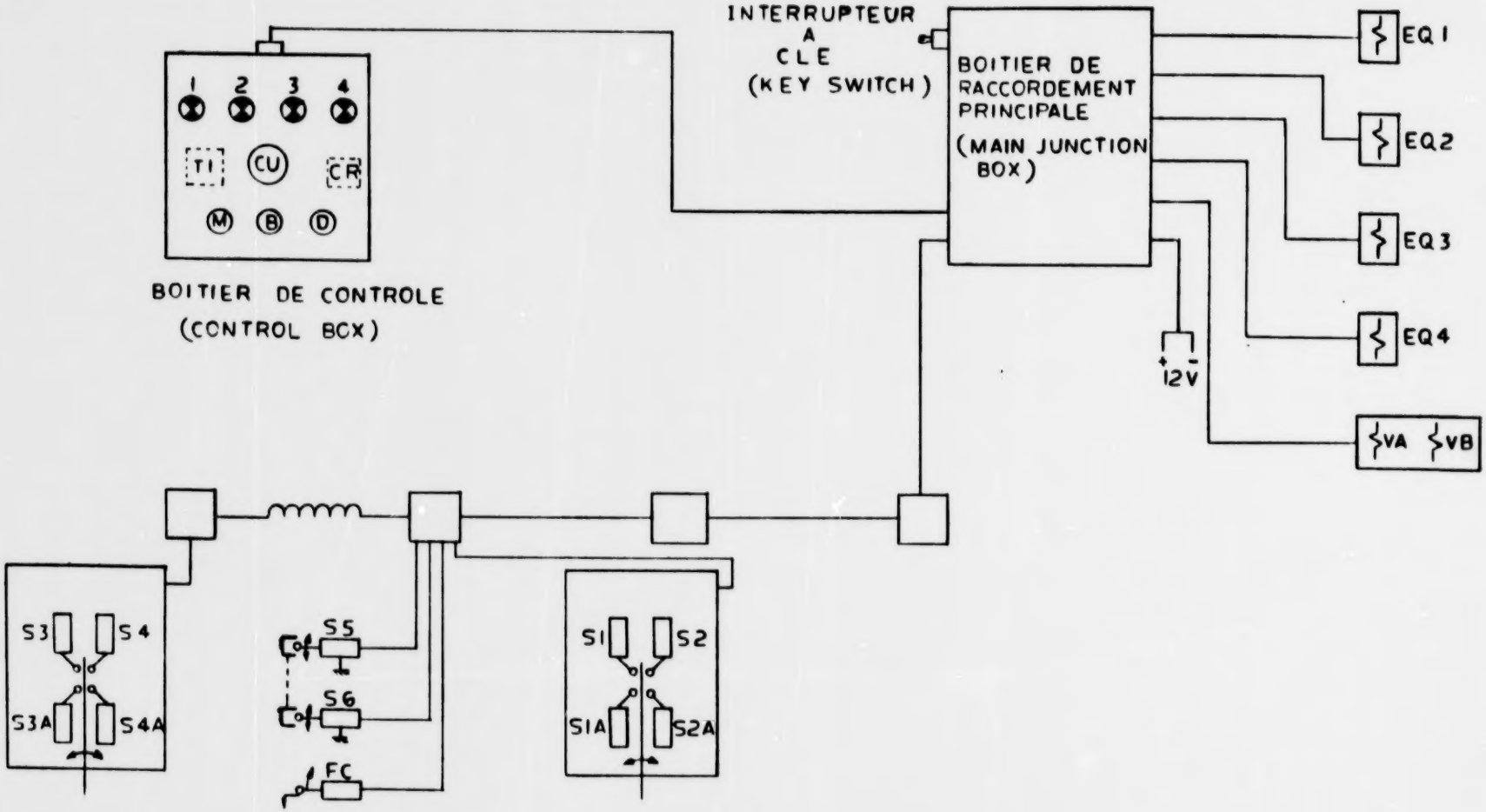


J-

SCHEMA DE PRINCIPE DU SYSTEME ELECTRIQUE

ITEM	LOCALISATION	DESCRIPTION	QTE
	B'te de raccord't Junction box	Interrupteur à clé Key switch	1
	B'te de contrôle Control box	Arrêt d'urgence Emergency push button	1
		Fusible 10 A 10 A fuse	1
M	"	Bouton poussoir "MONTEE" "UP" push button	1
D	"	Bouton poussoir "DESCENTE" "DOWN" push button	1
VA-VB	Groupe hydraulique Hydraulic group	Electrovalve "MONTEE-DESCENTE" Electrovalve "UP-DOWN"	1
T1	B'te de contrôle Control box	Relais temporisé Timer	1
CR	"	Relais de contrôle Control relay	1
FC	Centre table Center of table	Interrupteur de fin de course Limit switch	1
S1-S2	B'te sync. cyl. #2 Sync. box cyl. #2	Interrupteur de contrôle du niveau Level control switch	2
S3-S4	B'te sync. cyl. #3 Sync. box cyl. #3	Interrupteur de contrôle du niveau Level control switch	2
S5	Centre la table Center of table	Interrupteur de synchro. des plateformes Plateforme synchro. switch	1
S6		Interrupt. limit de synch. des plateform. Plateforme synchro. limit switch	1
S1A-S2A	B'te sync. cyl. #2 Sync. box cyl. #2	Interrupteur limit de contrôle du niveau Level limit control switch	2
S3A-S4A	B'te sync. cyl. #3 Sync. box cyl. #3	Interrupteur limit de contrôle du niveau Level limit control switch	2
EQ1 ... EQ4	Groupe hydraulique Hydraulic group	Electrovalve d'égalisation Equalising electrovalve	4
L1 ... L4	B'te de contrôle Control box	Lampe témoin Pilot light	4
		Alarme sonore Buzzer	1
D1 ... D10	B'te raccordement Junction box	Diode Diode	10
D11 ... D14	B'te de contrôle Control box	Diode Diode	4





SCHEMA DE CABLAGE

LISTE DE PIECES

REVISION

ITEM	DESCRIPTION	SYMBOLE	FABRICANT	Nº DE PIÈCE	QUA
	Fiche multi-contacts		Amphenol	97-3102A-20-27P	
	Prise multi-contacts		Amphenol	97-3106A-20-27S	
	Interrupteur	FC S1 S2 S3 S4 S1A S2A S3A S4A	A-B	802T-H	9
	Interrupteur	S5 S6	A-B	802T-NP	2
	Levier micrométrique		A-B	802T-W6	11
	Bouton poussoir momentané VERT	Descente	A-B	800T-A1A	1
	Bouton poussoir momentané ROUGE	Montée	A-B	800T-B6A	1
	Plaque signalétique MONTE		A-B	800T-X559	1
	Plaque signalétique DESCENTE		A-B	800T-X559	1
	Lampe indicatrice	L1 L2 L3 L4	A-B	800T-Q12R	4
	Ampoules 12V		GE	755	4
	Plaque signalétique CYLINDRE #1		A-B	A-B 800T-X559	1
	Plaque signalétique CYLINDRE #2		A-B	A-B 800T-X559	1
	Plaque signalétique CYLINDRE #3		A-B	A-B 800T-X559	1
	Plaque signalétique CYLINDRE #4		A-B	A-B 800T-X559	1
	Plaque signalétique ARRET D'URGENCE		A-B	A-B 800T-X559	1
	Relais temporisé (delay on release) 12VCC	T1	P & B	CWD-38-26000	1
	Embase de relais		P & B	27E-123	2
	Relais 12 VCC 3PDT	CR	P & B	KAP-14DG	1
	Bouton poussoir maintenu	Arrêt d'urgence	A-B	800T-FX604	1

PROJET Nº

EDITION

TITRE: LISTE DE MATERIEL ELECTRIQUE

DESSIN Nº: 368-00-02

PRÉPARÉ | J | M | A

VÉRIFIÉ | J | M | A

APPROUVÉ | J | M | A

FEUILLE 1

GC 07

LISTE DE PIECES

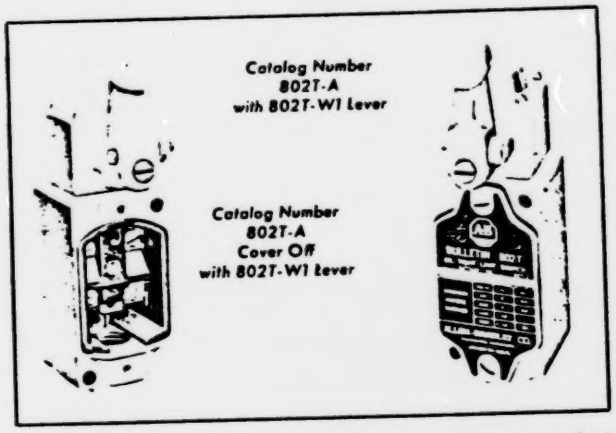
REVISION

ITEM	DESCRIPTION	SYMBOLE	FABRICANT	Nº DE PIÈCE	QUA
	Boîtier de contrôle		Hammond	1488-HH9	1
	Boîte étanche nema 4, 16" x 14" x 6"	Boîtier de rac't principal	Hammond	1414-N4PH06	1
	Boîte étanche nema 4, 8" x 12" x 4"		Hammond	1414-N4PHI	4
	Tuyaux rigides aluminium				30 m
	Condulet aluminium LL 1"		Crouse Hinds	LL39C	3
	Condulet aluminium LR 1"		C/H	LR39C	3
	"Bulle" "1" aluminium		Thomas & Betts	372AL	8
	Connecteur "strain relief" (#16-7)		T & B	2544	8
	Connecteur "strain relief" (16-14)		T & B	2546	2
	Connecteur "strain relief" (16/6)		T & B	2545	2
	Fils TEW #16-29STR NOIR				300 m
	Fils TEW #16-29STR ROUGE				300 m
	Fils TEW #16-29STR BRUN				600 m
	Fils TEW #16-29STR JAUNE				600 m
	Fils TEW #14 VERT				150 m
	Cordon flexible type SO #16/7 fils		O.D. 550		25 m
	Cordon flexible type SO #16/14 fils		O.D. 760		10 m
	Cordon rétractable type SO #16-6		O.D.		1
	1.2 M rétracté/6.1 en extension				
	INTERRUPTEUR A CLE		A-B	800T-FX604	

CENTRE DE RECHERCHE INDUSTRIELLE DU QUEBEC	PROJET Nº 4-0076	EDITION
TITRE TABLE DE RENVERSEMENT : LISTE DE MATERIEL ELECTRIQUE		DESSIN Nº 368-00-02
PRÉPARÉ JACQUES AUBIN J 03 M 09 A 85	VÉRIFIÉ J M A	APPROUVÉ J M A
		FEUILLE 2

BULLETIN
802T

OILTIGHT LIMIT SWITCHES



DESCRIPTION—The Bulletin 802T line is a wide, diversified selection of oiltight limit switches designed for the remote control of automatic starters and contactors, both AC and DC. Bulletin 802T's are ideal for any limit switch application in which heavy duty pilot ratings, small size, a high degree of versatility and a rugged, oiltight construction are desirable. An important factor in the automation of industry, these limit switches are being applied extensively on conveyor systems, transfer machines, automatic turret lathes, milling and boring machines, radial drills, and many other types of modern, high speed production equipment.

HIGH DEGREE OF VERSATILITY—Each Bulletin 802T can be adapted, easily and inexpensively, for many different kinds of installations. Switch enclosures can be mounted in any position; operating heads can be rotated and fastened in any one of four positions 90° apart; operating levers are interchangeable, and can be rotated and clamped in any position through 360°; and accessories can be added to switches already in the field.

OILTIGHT CONSTRUCTION—Synthetic rubber seals protect the operating parts against entry of oil, dust, abrasives and coolant.

RUGGED, DEPENDABLE CONTACT BLOCK—The contacts used in Bulletin 802T switches are snap action type with high snap-through force resulting in minimum contact rebound. Double break, fine silver contacts are electrically independent, but cannot be used on opposite polarities.

EASY MOUNTING AND WIRING—Each switch base has four mounting holes: two "through" holes for front mounting, and two tapped holes in the back for rear mounting. Removing the cover and cover gasket exposes the pressure plate type terminals on the contact block. These face to the front of the switch and have ample wiring space. The standard conduit opening is a ½" threaded tap in the bottom.

LEVER TYPE SWITCHES—These switches are operated by means of a lever which is clamped to a knurled shaft extending from the operating head. Moving the lever clockwise or counter-clockwise from the normal position operates the contacts.

Lever type switches can be equipped with any one of seven different operating levers: roller lever, adjustable roller lever, micrometer adjustment roller lever, rod lever, one-way rod or roller lever and fork lever. These can be used interchangeably on all lever type switches except the low operating force switch, which requires the lever identified by catalog number 802T-W5.

The micrometer adjustment roller lever, catalog number 802T-W6, is designed especially for installations where the exact position of the roller is a critical factor. This lever has a pivoted roller which can be turned laterally. After clamping the lever to the switch shaft, the position of the roller can be precisely adjusted through an arc of 7½° on either side of the center or straight-line position.

PUSH TYPE SWITCHES—These switches are actuated by means of a rod or plunger located on the top or side of the operating head. Pushing the plunger into the head causes the contacts to operate. Two kinds of plunger are available: button type and steel roller. Push type switches can be supplied in spring return and maintained contact constructions. All use the standard contact block.

WOBBLE STICK AND CAT WHISKER TYPE SWITCHES—Both switches are actuated by a rod or stick extending from the top of the operating head. Moving the rod in any direction causes the contacts to operate. All wobble stick and cat whisker switches have the standard contact block, and are supplied in the spring return construction only.

DUAL SWITCHES—The dual switch is actually two limit switches—two actuator-contact block combinations—which function independently but have a common enclosure. For installations where two switches would be mounted side by side. There is a saving on installation time and fittings.

PLUG-IN SWITCHES—The plug-in limit switch line can reduce costly downtime when switch replacement is often required. The same base is common to the entire line, any type of actuator and contact block combination can be plugged in and fastened in minutes.

TWO POLE SWITCHES—Two pole switches contain two standard, single pole contact blocks, providing a total of two NO and two NC contacts. The blocks are mounted one on top of the other in the vertical limit switch construction, or along side of each other in the horizontal construction. Switch plungers are mechanically coupled in both constructions. When actuated, contacts in the two blocks are operated.

CONTACT RATINGS—A600

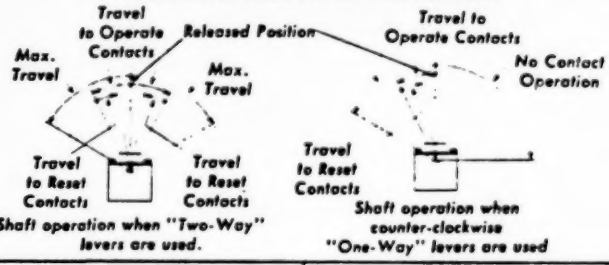
A.C. Control Circuit	⟲	⟳	D.C. Control Circuit	Contact Rating
120-600 V	720 VA	7200 VA	115-125 V	0.4 A
			230-250 V	0.2 A
6-72 V	10 Amp.	60 Amp.	550-600 V	0.1 A

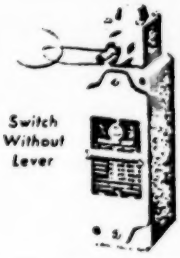
OILTIGHT LIMIT SWITCHES

LEVER TYPE

SPRING-RETURN LEVER MOVEMENT

Switch Without Lever





Switch Without Lever

SINGLE POLE, DOUBLE THROW

Shaft Movement and Contact Action	Operating Torque	Travel to Operate Contact (Max.)	Max. Travel	Travel to Reset Contact (Max.)	Catalog Number	Price
Clockwise or Counter-Clockwise	3 In.-Lbs.	16.5°	43°	8°	802T-A	$29
	4.5 In.-Lbs.	6°	53°	3°	802T-H	31
Clockwise [1]	3.5 In.-Lbs.	16.5°	43°	8°	802T-A1	29
	1.5 In.-Lbs.	15°	53°	8°	802T-A3 [1]	29
	4.5 In.-Lbs.	6°	50°	3°	802T-H1	31
Counter-Clockwise [1]	3.5 In.-Lbs.	16.5°	43°	8°	802T-A2	29
	1.5 In.-Lbs.	15°	43°	8°	802T-A4 [1]	29
	4.5 In.-Lbs.	6°	50°	3°	802T-H2	31
Clockwise (Shaft cannot move counter-clockwise)	4 In.-Lbs.	20°	91°	11°	802T-L1	31
Counter-Clockwise (Shaft cannot move clockwise)	4 In.-Lbs.	20°	91°	11°	802T-L2	31
NEUTRAL POSITION • SPRING RETURN						
Normally Open Contacts	2.25 In.-Lbs.	12°	53°	6°	802T-NP	41

DOUBLE POLE, DOUBLE THROW

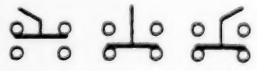
Shaft Movement and Contact Action	Operating Torque	Travel to Operate Contact (Max.)	Max. Travel	Travel to Reset Contact (Max.)	Catalog Number	Price
Clockwise or Counter-Clockwise	3 In.-Lbs.	18°	42°	14°	802T-AT	$72
	6 In.-Lbs.	9°	53°	6°	802T-HT	74
Clockwise	3.5 In.-Lbs.	18°	42°	14°	802T-A1T	72
	6 In.-Lbs.	9°	53°	6°	802T-H1T	74
Counter-Clockwise	3.5 In.-Lbs.	18°	42°	14°	802T-A2T	72
	6 In.-Lbs.	9°	53°	6°	802T-H2T	74
Clockwise (Shaft cannot move counter clockwise)	4 In.-Lbs.	28°	91°	18°	802T-L1T	74
Counter-Clockwise (Shaft cannot move clockwise)	4 In.-Lbs.	28°	91°	18°	802T-L2T	74
MAINTAINED-CONTACT LEVER MOVEMENT						
	2.25 In.-Lbs.	70°	84°	35°	802T-AM	35
	3 In.-Lbs.	75°	84°	50°	802T-AMT	78

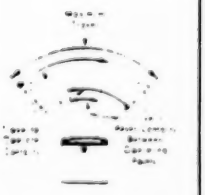
[1] Catalog Numbers 802T-A3 and 802T-A4—As listed in the table, Catalog Numbers 802T-A3 and 802T-A4 are uniquely different from the standard lever-type spring-return switches; they feature greater damping on the return stroke and a provision for field change in direction of operation, (clockwise to counter-clockwise or vice-versa)

NOTE: A reduction in damping will occur when modified for high temperature application

802T-A3

802T-A4





Maintained Contact

Modifications and Accessories—Refer to Page 121. Levers—Refer to Page 118

BULLETIN **802T**

OILTIGHT LIMIT SWITCHES

The levers shown in the table below are to be used with Bulletin 802T, 802R and 802X limit switches.

OPERATING LEVERS

ROLLER LEVER

Type	Material	Diameter	Width	Catalog No	Price
Non Adjustable 1" Radius except 802T-W9 which is ¼"	Nylon	¾"	9/32"	802T-W1	$3
	Nylon	¾"	1"	802T-W1H	5
	Steel	¾"	¼"	802T-W1A	3
	Ball Bearing	¾"	15/64"	802T-W1B	7
	Beryllium Copper (Non-Sparking)	¾"	9/32"	802T-W1J	8
	Nylon	¾"	9/32"	802T-W9	4
Non Adjustable Roller on Back 1" Radius	Nylon	¾"	9/32"	802T-W1E	3
	Nylon	¾"	1"	802T-W1D	5
	Nylon	1½"	9/32"	802T-W1G	3
	Steel	¾"	¼"	802T-W1F	3
	Steel	¾"	¾"	802T-W1C	5
Adjustable 1¾"-3" Radius	Nylon	¾"	9/32"	802T-W2	5
	Nylon	¾"	1"	802T-W2D	9
	Nylon	1½"	9/32"	802T-W2A	7
	Steel	¾"	¼"	802T-W2B	5
	Ball Bearing	¾"	15/64"	802T-W2C	7
Fork Lever 1½" Radius	Nylon LH Roller on Front RH Roller on Back	¾"	9/32"	802T W4	5
	Steel LH Roller on Front RH Roller on Back	¾"	¼"	802T-W4B	5
	Nylon Both Rollers on Front	¾"	9/32"	802T-W4A	5
	Nylon Both Rollers on Front	¾"	1"	802T-W4F	9
	Steel Both Rollers on Front	¾"	¼"	802T-W4C	5
1½" Radius Micrometer Adjustment	Nylon	¾"	9/32"	802T-W6	8.50
	Steel	¾"	¼"	802T-W6A	8.50
	Ball Bearing	¾"	15/64"	802T-W6B	15.50
One-Way 1½" Radius	Nylon	¾"	9/32"	802T-W7 [1]	16
	Steel	¾"	¼"	802T-W7A [1]	16
	Ball Bearing	¾"	15/64	802T-W7B [1]	20
Non-Adjustable Offset 1½" Radius	Nylon	¾"	9/32"	802T-W12 [2]	3
	Steel	¾"	9/32"	802T-W12A [2]	3

ROD LEVER

Type	Material	Diameter	Catalog No	Price
	Stainless Steel Rod 5" Radius	⅛"	802T-W3	$5
	Stainless Steel Rod 8½" Radius	⅛"	802T-W3B	6
	Stainless Steel Rod 11½" Radius	9/64"	802T-W3A	5
	Nylon Rod 12" Radius	¼"	802T-W3C	7
	Stainless Steel Rod 5" Radius	1/16"	802T-W5 [3]	5
One-Way	Stainless Steel Rod 5" Radius	1/16"	802T-W8	10
	Nylatron 6" Radius 2" width of loop	3/16"	802T-W14	7

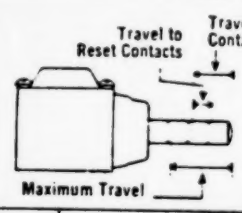
[1] Do not use on maintained-contact limit switches.

[2] When mounted on plug-in devices, the offset lever provides equivalent cam tracking to the non plug-in devices using Catalog No. 802T-W1 levers.

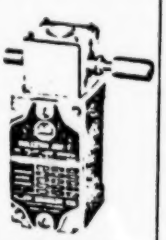
[3] Recommended for use with low-operating force switches.

OILTIGHT LIMIT SWITCHES

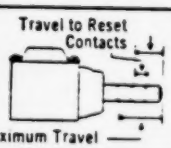
PUSH TYPE • SPRING RETURN AND MAINTAINED CONTACT
SINGLE POLE, DOUBLE THROW

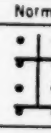
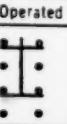
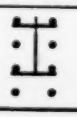
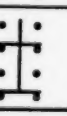


	Normal	Operated
Top Push Type		
Side Push Type		

	SPRING RETURN				MAINTAINED CONTACT
	TOP PUSH ROD	SIDE PUSH ROD	TOP PUSH ROLLER	SIDE PUSH ROLLER	 SIDE PUSH ROD
Catalog Number	802T-B	802T-C	802T-D	802T-K Roller Vertical 802T-K1 Roller Horizontal	802T-CM
Price	**$32**	**$34**	**$34**	**$38**	**$40**
Operating Force	3.5 Lbs.	4.5 Lbs.	3.5 Lbs.	4.5 Lbs.	8 Lbs.
Travel to Operate Contact (Max.)	.075"	.125"	.075"	.125"	.234"
Maximum Travel	.202"	.218"	.202"	.218"	.296"
Travel to Reset Contact (Max.)	.030"	.057"	.030"	.057"	.202"

2 POLE CONSTRUCTION
DOUBLE POLE, DOUBLE THROW



	Normal	Operated
Top Push Type		
Side Push Type		

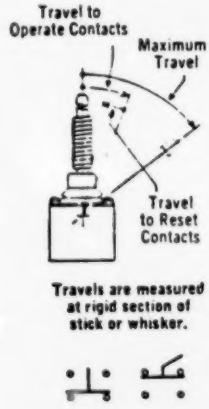
	SPRING RETURN				MAINTAINED CONTACT
	TOP ROD	SIDE ROD	TOP ROLLER	SIDE ROLLER	SIDE ROD
Catalog Number	802T-BT	802T-CT	802T-DT	802T-KT Roller Vertical 802T-K1T Roller Horizontal	802T-CMT
Price	**$75**	**$77**	**$77**	**$81**	**$83**
Operating Force	5.5 Lbs.	6.5 Lbs.	5.5 Lbs.	6.5 Lbs.	14 Lbs.
Travel to Operate Contact (Max.)	.140"	.140"	.140"	.140"	.234"
Maximum Travel	.234"	.234"	.234"	.234"	.265"
Travel to Reset Contact (Max.)	.062"	.094"	.062"	.094"	.202"

tifications and Accessories—Refer to Page 121.

OILTIGHT LIMIT SWITCHES

WOBBLE STICK • CAT WHISKER
SINGLE POLE, DOUBLE THROW

NOTE—These switches should be mounted in such a way that the wobble stick or cat whisker will not be deflected beyond the "Maximum Travel" position. This is to prevent excessive backlash, which could cause undesirable repetition of contact action.



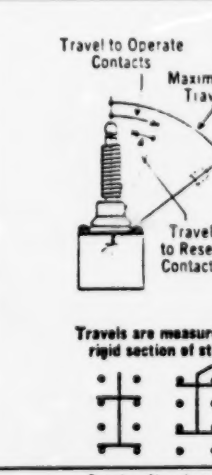
Wobble Stick Nylon Extension

Wobble Stick Wire Extension

Cat Whisker

	Wobble Stick Nylon Extension	Wobble Stick Wire Extension	Cat Whisker
Catalog Number	802T-WS	802T-WS1	802T-CW
Price	**$32**	**$32**	**$32**
Operating Torque [1]	4.5 In.-Lbs.	4.5 In.-Lbs.	8 In.-Oz.
Travel to Operate Contact (Max.) [1]	9°	9°	21°
Maximum Travel [1]	10°	10°	22°
Travel to Reset Contact (Max.) [1]	4°	4°	14°

WOBBLE STICK
DOUBLE POLE, DOUBLE THROW



Nylon

Wire

	Nylon	Wire
Catalog Number	802T-WST	802T-WS1T
Price	**$75**	**$75**
Operating Torque [1]	7 In.-Lbs.	
Travel to Operate Contact (Max.) [1]	12°	
Maximum Travel [1]	12°	
Travel to Reset Contact (Max.) [1]	9°	

[1] Operating travels and torque are measured at the rigid section of stick or whisker.

LEVER OPERATED • TIME DELAY

DESCRIPTION—The Bulletin 802T time delay oiltight limit switch incorporates a pneumatic timer to produce a time delay before energizing or de-energizing a control circuit. Two general types of limit switches are available. One type delays the contact operation until after the lever has been moved from the normal to the operated position; the other type provides the delay in contact operation after the lever has moved from the operated to the normal position. The delay period is adjustable from ½ second to 15 seconds ± 25%.

The time delay limit switch is completely oiltight, and offers most of the features of the standard Bulletin 802T limit switches.

An application example is a counter-boring operation in which the downward feed must be stopped before the bore stops turning. An "On-Delay" Type **802T-R3TD** limit switch would allow the bore to dwell for a preset period after the feed drive has been stopped by a limit switch.

NOTE—When using "On-Delay" switches, lever travel must be faster than time setting.

CONTACT RATINGS—Contacts are rated for pilot duty only at 3 amperes, 120 volts maximum.

Lever Operation	Contact Position: Normal	Contact Position: Operated	Catalog Number: On-Delay (Time delay occurs after lever is moved to operated position)	Catalog Number: Off-Delay (Time delay occurs after lever has moved from operated to normal position)	Price
Clockwise Lever can't move counter-clockwise			802T-R1TD	802T-R7TD	$52
			802T-R3TD	802T-R5TD	
Counter-clockwise Lever can't move clockwise			802T-R2TD	802T-R8TD	
			802T-R4TD	802T-R6TD	

Operating Torque	2 In.-Lbs.
Pre-travel	45°*
Overtravel	45°
Maximum Travel	Approx. 90°
	*Required for Timing Accuracy

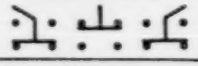
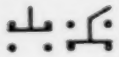
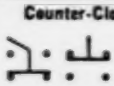
Levers—Refer to Page 118

OILTIGHT LIMIT SWITCHES

LOW OPERATING FORCE

These low operating force limit switches can only be supplied with the catalog number **802T-W5** rod lever. The rod can easily be formed to meet special application requirements.

SPRING RETURN—In this limit switch the contacts are restored to their normal position when pressure on the rod is released.

Operating Torque	12.5 In.-Oz.	Switch With W5 Rod Lever	
Travel to Close Contact (Max.)	22°		
Maximum Travel	43°	Catalog Number	Price
Travel to Reset Contact (Max.)	12°		
Clockwise or Counter-Clockwise 		802T-ALW5	$40
Clockwise Lever cannot move counter-clockwise 		802T-AL1W5	40
Counter-Clockwise  Lever cannot move clockwise		802T-AL2W5	40

AIR-OPERATED

Catalog No.	Price
802T-P	$52

Bulletin 802T air-operated oiltight limit switches will operate when 20 P.S.I. ±25% of air pressure is applied, and will reset with a pressure drop of from 5 to 10 pounds. A small rod protrudes from the top of the die casting. With the switch not operated, rod extends beyond the surface. With the switch operated, the rod is flush with the surface. The switch can be manually operated by pushing down on the indicator rod. Maximum continuous pressure is 100 P.S.I.

MODIFICATIONS and ACCESSORIES

Modifications and accessories do not apply to the plug-in, the low-operating force, the air-operated, the time-delay or the two-pole type of limit switches.

MANIFOLD MOUNTING—Bulletin 802T switches can be supplied with a special base which permits mounting the switch manifold style on a machine base, panel or raceway. This base is equipped with a wiring hole and synthetic rubber gasket on the back (see illustration).

To order a switch with a manifold mounting base, add the letter **"U"** to the catalog number, and add **$4** to the list price. Example: Catalog number **802T-AMW4A,** list price **$40**, becomes catalog number **802T-AMUW4A** (shown) at a list price of **$44.**

TRANSPARENT COVER—Switches can be furnished with a gasketed, transparent plastic cover. This modification enables the electrician to inspect terminal wiring without removing the switch cover.

To order a switch with a transparent cover, add the letter **"Z"** to the catalog number of the standard switch, and add **$3** to the list price. For example, catalog number **802T-D,** list price **$34,** becomes catalog number **802T-DZ** list price **$37.**

SPECIAL OILTIGHT BUSHINGS—This bushing, a "Tru-Seal" nut with threaded teflon insert, is a valuable accessory for any Bulletin 802T which is connected by means of conduit.
½" Bushing—Cat. No. **802T-X4** **$1.50**

HIGH TEMPERATURE OPERATION—Bulletin 802T limit switches are designed to operate in a temperature range of −18°C to +54°C (0° to +130°F.) Special limit switches modified for high temperature operation −29°C to +121°C (−20° to +250°F) are available.

NOTE: Minimum temperature is based on the absence of freezing moisture or water.

To order a Bulletin 802T modified for high temperature operation, insert the letter **"E"** after the operating head designation and add **$8** to the list price. Example: Catalog number **802T-AW1,** list price **$32,** becomes catalog number **802T-AEW1,** list price **$40.** (Catalog numbers **802T-W5, W51, CW** and the Time Delay limit switches are not available for high temperature operation. Catalog numbers **802T-A3** and **A4** are available for high temperature operation except with a reduction in damping).

NEON INDICATING LIGHTS—Bulletin 802T Standard Surface Mounted Limit Switches can be supplied with neon indicating lights—AC 208 240V, 50-60 Hz. and 120V, 50-60 Hz.

To order a limit switch with indicating lights, add the letter **"N"** for 120V or **"N5"** for 240V before the lever designation and add **$15** list to the standard switch price; Example: Catalog Number and price of a standard **802T-A1W3** with indicating lights would be **802T-A1NW3 $49** list.

In addition, indicating light kits are available for field installation.

Construction	VOLTAGE-AC		Price
	120V 50-60 Hz	208 240V 50-60 Hz	
Standard Switch	802T-N1	802T-N4	$15
Neutral Position Switch	802T-N2	802T-N10	

BULLETIN **802T**

OILTIGHT LIMIT SWITCHES

PLUG-IN CONSTRUCTION—EEMAC TYPE 4 WATERTIGHT—EEMAC TYPE 13 OILTIGHT

DESCRIPTION—These limit switches can reduce costly down-time when switch replacement is often required. The two circuit base is common to the entire two circuit line—any type of actuator and contact combination can be plugged in and fastened in minutes. This same feature also applies to the four circuit base. All that is required is loosening the two front captive screws, unplugging the switch unit from the base and replacing. Simple.

With the switch unit removed, the terminals are readily available with adequate room for easy wiring. Contact wiring is accomplished with pressure connectors. The contacts of the switch provide high snap-through force for positive switching action. The double break, fine silver contacts are electrically independent but polarity must be observed in wiring. Design of these contacts promotes extended electrical and mechanical life.

The location of the mounting holes on these switches coincides with that of our present non plug-in type limit switches.

The lever type spring-return switches are field convertible to any of three arrangements—clockwise and counter clockwise, clockwise only or counter clockwise only. Instructions are included with each switch.

ORDERING INFORMATION—Order by catalog number. Select desired lever.

TWO CIRCUIT SWITCHES

CONTACT RATINGS—All units except Catalog Numbers 802T-ALP, AL1P, AL2P, ALP1, AL1P1 and AL2P1.

A600:

A.C. Control Circuit	↔	→	D.C. Control Circuit	Contact Rating
120-600 V	720 VA	7200 VA	115-125 V 230-250 V	0.4 A 0.2 A
6-72 V	10 Amp	60 Amp.	550-600 V	0.1 A

CONTACT RATING—Catalog Number 802T-ALP, AL1P, AL2P, ALP1, AL1P1 and AL2P1.

B600

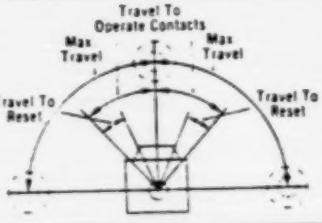
A.C. Control Circuit	↔	→	D.C. Control Circuit	Contact Rating
120-600 V	360 VA	3600 VA	115-125 V 230-250 V	0.4 A 0.2 A
6-72 V	5 Amp.	30 Amp.	550-600 V	0.1 A

FOUR CIRCUIT SWITCHES

CONTACT RATINGS—A300

A.C. Control Circuit	↔	→	D.C. Control Circuit	Contact Rating
120-300 V 6-72 V	720 VA 10 Amp	7200 VA 60 Amp.	115-125 V 230-250 V	0.4 A 0.2 A

LEVER TYPE • SPRING RETURN



—NOTE—

Contacts of Catalog Numbers 802T-AP, 802T-ATP, 802T-ALP, 802T-HP and 802T-HTP operate when lever is moved in either direction.

Contacts of Catalog Numbers 802T-A1P, 802T-A2P, 802T-A1TP, 802T-A2TP, 802T-AL1P, 802T-AL2P, 802T-H1P, 802T-H2P, 802T-H1TP, and 802T-H2TP operate when lever is moved in one direction. See contact target below.

Switch Without Lever

Switch Without Lever and Base

No. of Circuits	LEVER MOVEMENT AND CONTACT OPERATION	Required Operating Torque	Travel to Operate Contact (Max.)	Max. Travel	Travel to Reset Contact (Max.)	Catalog Number	Price	Catalog Number	Price
2 Circuit	Clockwise or Counter-Clockwise	2.6 In.-Lbs.	13°	75°	7°	802T-AP	537	802T-AP1	528
		15 In.-Ozs.	13°	75°	7°	802T-ALP [1]	45	802T-ALP1 [1]	36
		5 In.-Lbs.	9°	75°	3.5°	802T-HP	40	802T-HP1	31
	Clockwise	2.6 In.-Lbs.	13°	75°	7°	802T-A1P	37	802T-A1P1	28
		15 In.-Ozs.	13°	75°	7°	802T-AL1P [1]	45	802T-AL1P1 [1]	36
		5 In.-Lbs.	9°	75°	3.5°	802T-H1P	40	802T-H1P1	31
	Counter-Clockwise	2.5 In.-Lbs.	13°	75°	7°	802T-A2P	37	802T-A2P1	28
		15 In.-Ozs.	13°	75°	7°	802T-AL2P [1]	45	802T-AL2P1 [1]	36
		5 In.-Lbs.	9°	75°	3.5°	802T-H2P	40	802T-H2P1	31
4 Circuit	Clockwise or Counter-Clockwise	4 In.-Lbs.	13°	75°	7°	802T-ATP	45	802T-ATP1	36
		7 In.-Lbs.	9°	75°	3.5°	802T-HTP	48	802T-HTP1	39
	Clockwise	4 In.-Lbs.	13°	75°	7°	802T-A1TP	45	802T-A1TP1	36
		7 In.-Lbs.	9°	75°	3.5°	802T-H1TP	48	802T-H1TP1	39
	Counter-Clockwise	4 In.-Lbs.	13°	75°	7°	802T-A2TP	45	802T-A2TP1	36
		7 In.-Lbs.	9°	75°	3.5°	802T-H2TP	48	802T-H2TP1	39

[1] Use only with Catalog Numbers 802T-W3 and 802T-W5 formable stainless steel operating levers at $5 list each.

LEVERS—See listing on Page 118.

Modifications and Accessories—Refer to Page 124

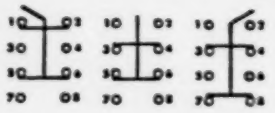
OILTIGHT LIMIT SWITCHES

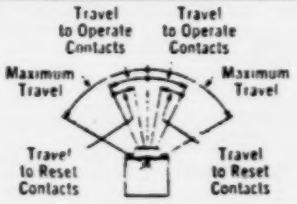
PLUG-IN CONSTRUCTION—EEMAC TYPE 4 WATERTIGHT—EEMAC TYPE 13 OILTIGHT

NEUTRAL POSITION • SPRING RETURN

LEVERS—See listing on Page 118 for levers available for these switches.

LEVER MOVEMENT AND CONTACT OPERATION



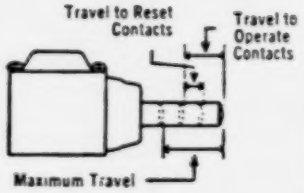


Switch Without Lever

Switch Without Lever and Base

Operating Torque		Travel to Operate Contact	Max. Travel	Travel to Reset Contact	Switch Without Lever		Switch Without Lever and Base	
Clockwise	Counter-Clockwise				Catalog Number	Price	Catalog Number	Price
2.5 In.-Lbs.	4.2 In.-Lbs.	13°	75°	7°	802T-NPTP	$48	802T-NPTP1	$39

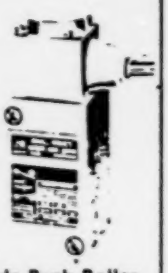
PUSH TYPE • SPRING RETURN



Top Push Rod

Side Push Rod

Top Push Roller



Side Push Roller

No. of Circuits	CONTACT OPERATION			Top Push Rod		Side Push Rod		Top Push Roller		Side Push Roller	
	Normal	Operated		Complete Switch	Switch Without Base	Complete Switch	Switch Without Base	Complete Switch	Switch Without Base	Complete Switch	Switch Without Base
2 Circuit			Catalog Number	802T-BP	802T-BP1	802T-CP	802T-CP1	802T-DP	802T-DP1	802T-KP Roller Vertical	802T-KP1 Roller Vertical
										802T-K1P Roller Horizontal	802T-K1P1 Roller Horizontal
			Price	$41	$32	$44	$35	$44	$35	$49	$40
Required Operating Force				3.1 Lbs.		3.7 Lbs.		3.1 Lbs.		3.7 Lbs.	
Travel to Operate Contacts (Max.)				.057 Inch		.114 Inch		.057 Inch		.114 Inch	
Maximum Travel				.236 Inch		.226 Inch		.236 Inch		.226 Inch	
Travel to Reset Contacts (Max.)				.028 Inch		.058 Inch		.028 Inch		.058 Inch	
4 Circuit	CONTACT OPERATION			Complete Switch	Switch Without Base	Complete Switch	Switch Without Base	Complete Switch	Switch Without Base	Complete Switch	Switch Without Base
	Normal	Operated									
			Catalog Number	802T-BTP	802T-BTP1	802T-CTP	802T-CTP1	802T-DTP	802T-DTP1	802T-KTP Roller Vertical	802T-KTP1 Roller Vertical
										802T-K1TP Roller Horizontal	802T-K1TP1 Roller Horizontal
			Price	$49	$40	$51	$42	$51	$42	$57	$48
Operating Force (Max.)				5 Lbs.		5.1 Lbs.		5 Lbs.		5.1 Lbs.	
Travel to Operate Contacts (Max.)				.057 Inch		.114 Inch		.057 Inch		.114 Inch	
Maximum Travel				.236 Inch		.226 Inch		.236 Inch		.226 Inch	
Travel to Reset Contacts (Max.)				.028 Inch		.058 Inch		.028 Inch		.058 Inch	

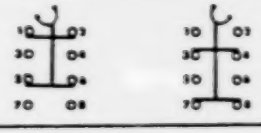
Modifications and Accessories—Refer to Page 124.

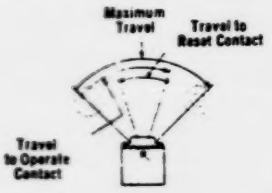
OILTIGHT LIMIT SWITCHES

PLUG-IN CONSTRUCTION—EEMAC TYPE 4 WATERTIGHT—EEMAC TYPE 13 OILTIGHT

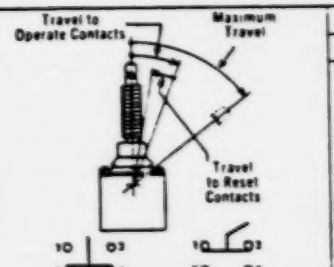
MAINTAINED-CONTACT LEVER MOVEMENT

LEVERS—See Page 118.

No. of Circuits	Lever Movement Contact Operation	Operating Force	Travel to Operate Contacts (Max.)	Maximum Travel	Travel to Reset Contacts (Max.)	Switch Without Lever		Switch Without Lever and Base	
						Catalog Number	Price	Catalog Number	Price
2 Circuit		2.75 in. lbs	61°	88°	28°	802T-AMP	$45	802T-AMP1	$36
4 Circuit		2.8 in. lbs	61°	88°	28°	802T-AMTP	53	802T-AMTP1	44



WOBBLE STICK—CAT WHISKER



Travels are measured at rigid section of stick or whisker.

Note – These switches should be mounted in such a way that the wobble stick or cat whisker will not be deflected beyond the "Maximum Travel" position. This is to prevent against excessive back lash which could cause undesirable repetition of contact action.

		WOBBLE STICK		CAT WHISKER
		Nylon Extension	Wire Extension	
Complete Switch	Catalog Number	802T-WSP	802T-WS1P	802T-CWP
	Price	$41	$41	$41
Switch Without Base	Catalog Number	802T-WSP1	802T-WS1P1	802T-CWP1
	Price	$32	$32	$32
Operating Torque [1]		4.5 in. Lbs	4.5 in. Lbs	8.0 in. Oz.
Travel to Operate Contacts (Max.) [1]		9°	9°	21°
Maximum Travel [1]		10°	10°	28°
Travel to Reset Contacts (Max.) [1]		5°	5°	14°

[1] Operating travels and torques are measured at the rigid section of stick or whisker.

MODIFICATIONS and ACCESSORIES

BASE ASSEMBLY—The limit switch base, including the terminal block is available as a separate unit.
2 Circuit Base.....Cat. No. **802T-X7** **$9**
2 Circuit Manifold Mount Base.....Cat. No. **802T-X7U** **14**
4 Circuit Base.....Cat. No. **802T-X8** **9**

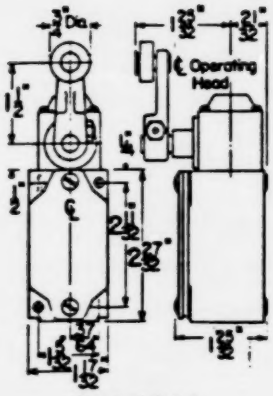
VITON SEALS—To order limit switches with viton seals, add the letter **"V"** to the end of the listed catalog number. Add **$9.50** to the lever type list price and **$12.50** to the push type, wobble stick and cat whisker list price. Not available on manifold mount, and low-operating torque limit switches.

LOW TEMPERATURE OPERATION—Plug-in limit switches are designed to operate in a temperature range of −18° to +110°C, (0° to +230°F) (−18° to +54°C, 0° to +130°F for wobble stick and cat whisker). Special limit switches modified for low temperature operation (−40° to +110°C, −40° to +230°F) are available (minimum temperature based on absence of freezing moisture or water. To order add the letter **"E"** to catalog number and **$8** to the list price. **Not available** on wobble stick or cat whisker. It's a standard feature on low torque devices.

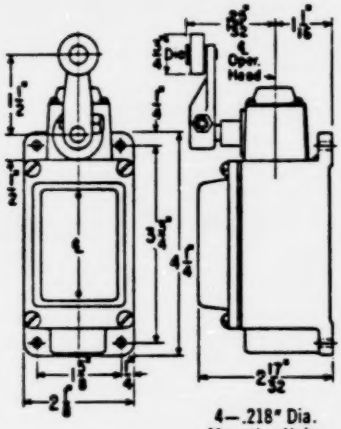
MANIFOLD MOUNT—All series D or E two-circuit plug-in limit switches can be supplied with a special terminal base which permits mounting the switch manifold style on a machine base, panel or raceway. This base is supplied with a wiring hole and gasket on the back. To order a manifold mount switch, add the letter **"U"** to the listed catalog number and **$4** to the list price.

OILTIGHT LIMIT SWITCHES

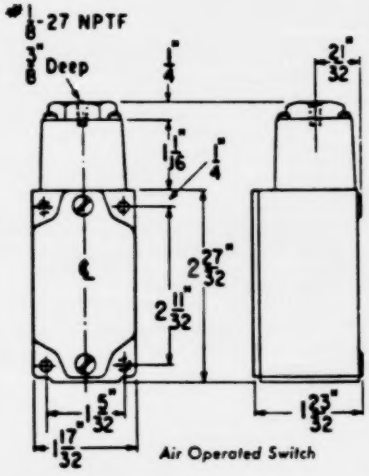
APPROXIMATE DIMENSIONS



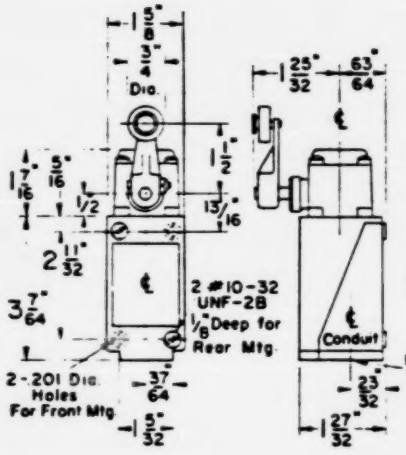
Standard Switch with 802T-W1 Lever



4—.218" Dia. Mounting Holes

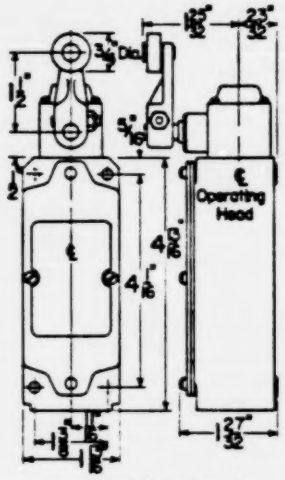


Air Operated Switch

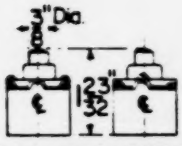


MOUNTING HOLE DIMENSIONS
(Unless otherwise indicated)

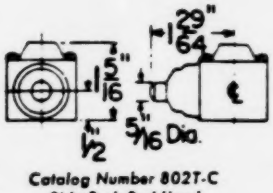
2—.203" Dia. holes for front mounting
2—#10-32 Tapped holes 3/8" deep for rear mounting
Conduit—1/2" pipe tap



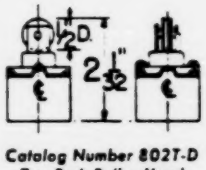
2 Pole Switch with 802T-W1 Lever



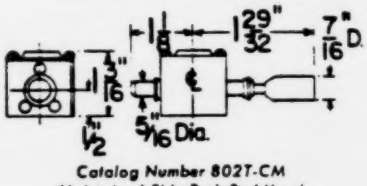
Catalog Number 802T-B
Top Push Rod Head



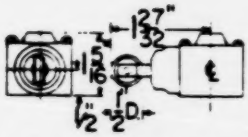
Catalog Number 802T-C
Side Push Rod Head



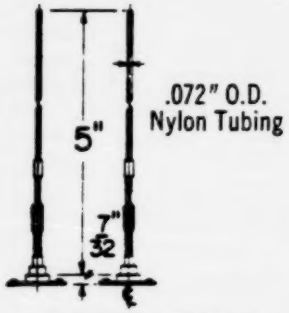
Catalog Number 802T-D
Top Push Roller Head



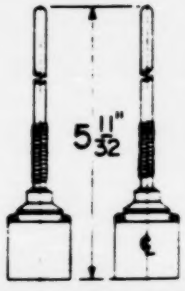
Catalog Number 802T-CM
Maintained Side Push Rod Head



Catalog Number 802T-K
Vertical Side Push Roller Head



Catalog Number 802T-CW
Cat Whisker Head



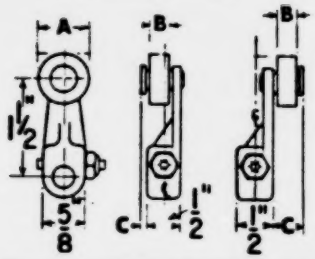
Catalog Number 802T-WS
Nylon Wobble Stick Head

Catalog Number 802T-WS1
Wire Wobble Stick Head

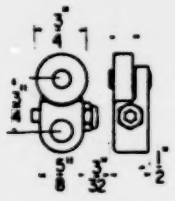
OILTIGHT LIMIT SWITCHES

APPROXIMATE DIMENSIONS

ROLLER LEVER

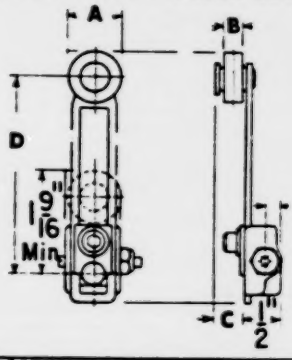


Catalog Nc.	Dimensions in Inches			
	A	B	C	Roller Mounting
802T-W1	¾	9/32	3/32	Front
W1A	¾	¼	3/32	Front
W1B	¾	15/64	1/32	Front
W1C	¾	¾	¾	Back
W1D	¾	1	1	Back
W1E	¾	9/32	25/64	Back
W1F	¾	¼	⅜	Back
W1G	1½	9/32	25/64	Back
W1H	¾	1	23/32	Front
W1J	¾	9/32	3/32	Front



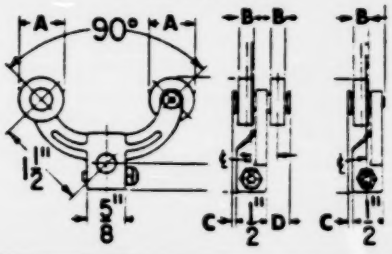
Catalog Number 802T-W9

ADJUSTABLE ROLLER LEVER



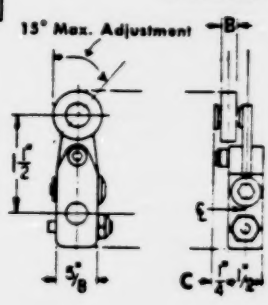
Catalog No.	Dimensions in Inches				
	A	B	C	D	
				Min.	Max.
802T-W2	¾	9/32	⅜	1 5/16	3
W2A	1½	9/32	⅜	1 5/16	3
W2B	¾	¼	⅜	1 5/16	3
W2C	¾	15/64	11/32	1 5/16	3
W2D	¾	1	1 11/32	1 5/16	3

FORK LEVER



Catalog No.	Dimensions in Inches				
	A	B	C	D	Roller Mounting
802T-W3	¾	9/32	3/32	13/32	Left-Front Right-Back
W4A	¾	9/32	3/32	—	Both Front
W4B	¾	¼	3/32	13/32	Left-Front Right-Back
W4C	¾	¼	3/32	—	Both Front
W4F	¾	1	23/32	—	Both Front

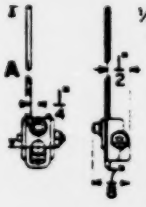
ROLLER LEVER, MICROMETER ADJUSTMENT

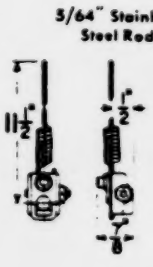


Catalog No.	Dimensions in Inches		
	A	B	C
802T-W6	¾	9/32	3/4
W6A	¾	3/4	3/4
W6B	¾	15/64	3/16

ROLLER LEVER, ONE-WAY OPERATION

Catalog No.	Dimensions in Inches	
	A	B
802T-W7	¾	9/32
W7A	¾	¼
W7B	¾	15/64

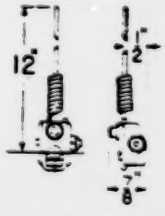




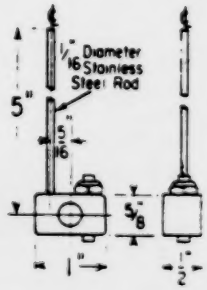
Catalog No.	A
802T-W3	5"
W3B	8½"

Catalog Number 802T-W3A

Rod Levers



Catalog Number 802T-W3C



Catalog Number 802T-W5

Catalog Number 802T-W8
One-Way Rod Lever

Refer to Page 118 for Prices.

ANNEXE C

Plateaux de pesage

- Dessin d'une cellule
- Localisation des cellules
- Facteur de calibration des cellules
- Branchements électriques des cellules de charge
- Spécifications du servo accéléromètre

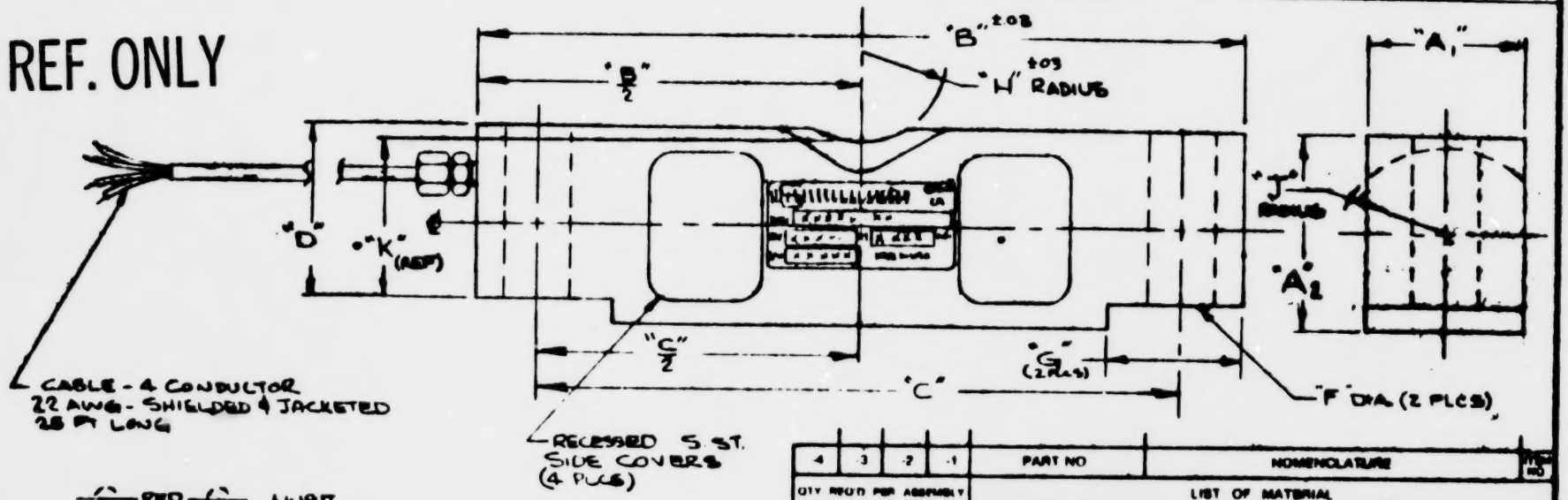
CRIQ

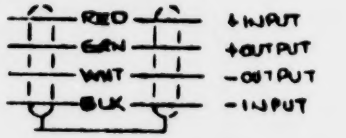
PART NO.	CAPACITY	A	A/2	B	C	D	F	G	H	J	K (REF)
-1	10K-25K	1.69	1.94	7.75	6.50	1.70	.68	1.58	.75	.90	1.63
-2	30K-40K	1.94	2.44	10.25	8.50	2.10	.81	1.93	1.00	1.12	2.00
-3	50K-75K	2.44	2.94	10.25	8.50	2.65	1.06	1.93	1.00	1.37	2.54
-4	90K-125K	2.90	3.86	15.25	12.75	3.43	1.60	3.13	1.50	1.80	3.30
-5	150K-200K	4.28	5.25	19.25	18.25	4.11	1.60	4.00	2.00	2.96	3.86

REV	ECN	DESCRIPTION	DATE	APPROVED
G	~	1) P 6 DIA - 4 PLA WAS 5.25 2) K DIM - 1 PLA WAS 1.71 PLA WAS 1.71 PLA WAS 1.26	5-21-84	
F	~	1) ADDED -6 PLA TO TABLE 2) DIM B WAS 10.25 - 10K/15K	4/11/84	
G	392	28 FT CABLE IN LIEU OF 20'	8/9/84	
H	412	1) .50 WAS .63, 1.25 WAS 1.44 2) 1.13 WAS 1.00 3) 1.81 WAS 1.75 4) 1.88 WAS 1.44	10/19/84	
J	419	1) ADDED -6 PLA TO TABLE 2) ADDED -6 PLA 2.00	11/21/84	

FEB 2 2 1985

REF. ONLY





WIRING DIAGRAM

-4	-3	-2	-1	PART NO	NOMENCLATURE	TYPE NO
QTY REQ'D PER ASSEMBLY				LIST OF MATERIAL		

MATERIAL: STEEL

HEAT TREAT:

FINISH: ELECTROLESS NICKEL PLATED

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
X ± .010
XX ± .030
XXX ± .005
ANGLES ± 0°30'

DRAWN BY: DATE

CHECKED BY: EF DATE

APPR BY: DATE

OTHER APPROVAL

Sensotec

RECTANGULAR DOUBLE ENDED SHEAR BEAM — DIMENSIONAL OUTLINE DWG.

SIZE: B

DWG NO: 65058-10K/200K

REV: J

SCALE: —

SHEET

FORM 164A

PREPARED BY		TS
E. Farr	838 EAST EDNA PLACE • COVINA, CA 91723	65058-10K/200K
APPROVALS		PAGE 1 OF 1 REV LTR

TECHNICAL SPECIFICATION

1 0 GENERAL DESCRIPTION:

1 1 Customer: Standard Product

1 2 Customer Part Number:

1 3 Dim Outline Dwg: 65058-10K/200K

2 0 PERFORMANCE SPECIFICATION:

2 1 Rated Capacity: 10K/200K Pounds

2 2 Rated Overload: 150 %

2 3 Rated Excitation: 15 VDC Volts

2 4 Bridge Resistance

Output: 700 ± 7 Ohms Input: 700 ± 7 Ohms

2 5 Full Scale Output: 3.0 MV/V Tolerance: ± 0.25 %FS

2 6 Zero Balance: ± 1 %FS

2 7 Creep: Less than .02% in 20 min.

2 8 Corner Load: N/A

Tolerance: N/A

Platform Size: N/A

Load: N/A

2 9 Linearity: .03 % Reading

2 10 Hysteresis: .02 %FS

2 11 Insulation Resistance 1000 Megohms @ 50 VDC

2 12 Compensated Temperature Range: 0-150 °F

2 13 Thermal Zero Shift: .0015 % FS/°F

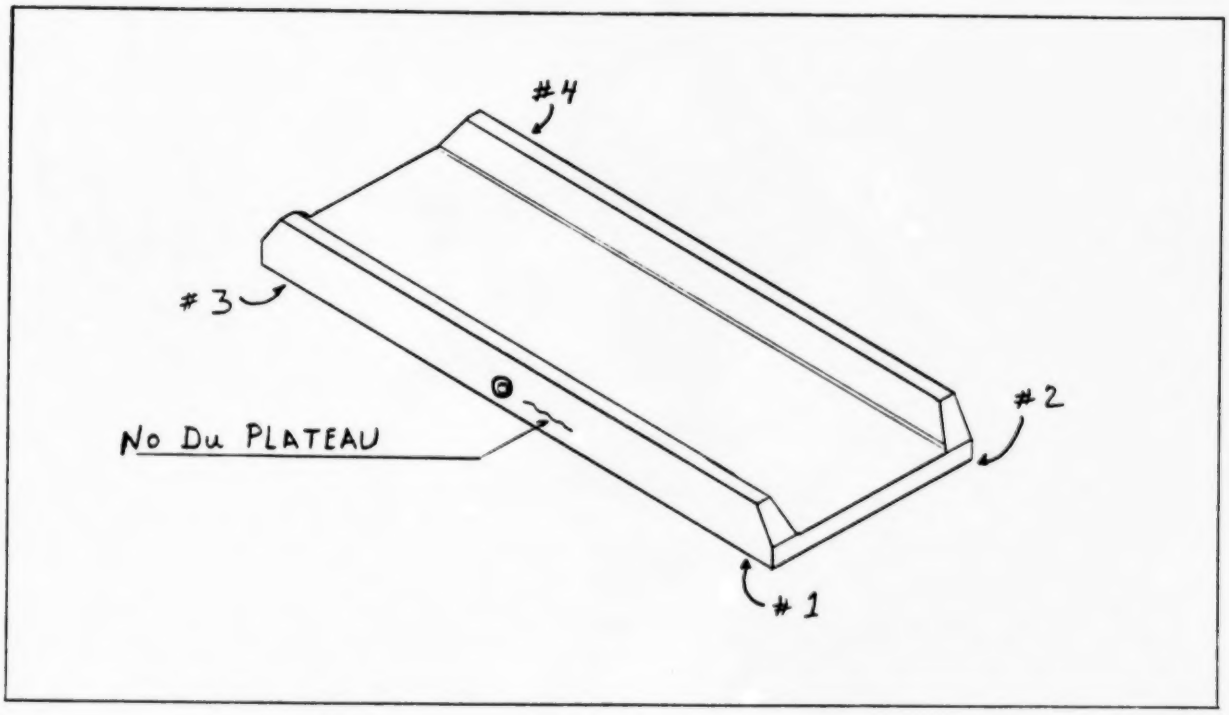
2 14 Thermal Sensitivity Shift: .0008 %/°F

2 15 Identification: Standard

CERTIFIED
FEB 2 2 1985

TABLEAU C-1

Identification des cellules de charge



Plateau pesage	Cellule no 1	Cellule no 2	Cellule no 3	Cellule no 4
1	100 410	100 412	100 418	100 415
2	100 402	100 408	100 407	100 406
3	100 404	100 417	100 405	100 409
4	100 413	100 414	100 416	100 411
5	100 400	100 403	100 401	100 399

CRIQ

TABLEAU C-2

Facteur de calibration des cellules de charge

Cellule no	Sortie à pleine échelle (Full scale output) (mV/V)
100 399	3,002
100 400	2,997
100 401	3,001
100 402	3,001
100 403	2,999
100 404	3,003
100 405	3,007
100 406	3,006
100 407	3,005
100 408	2,998
100 409	3,004
100 410	2,999
100 411	2,999
100 412	3,000
100 413	2,994
100 414	3,002
100 415	3,001
100 416	2,998
100 417	3,000
100 418	3,001

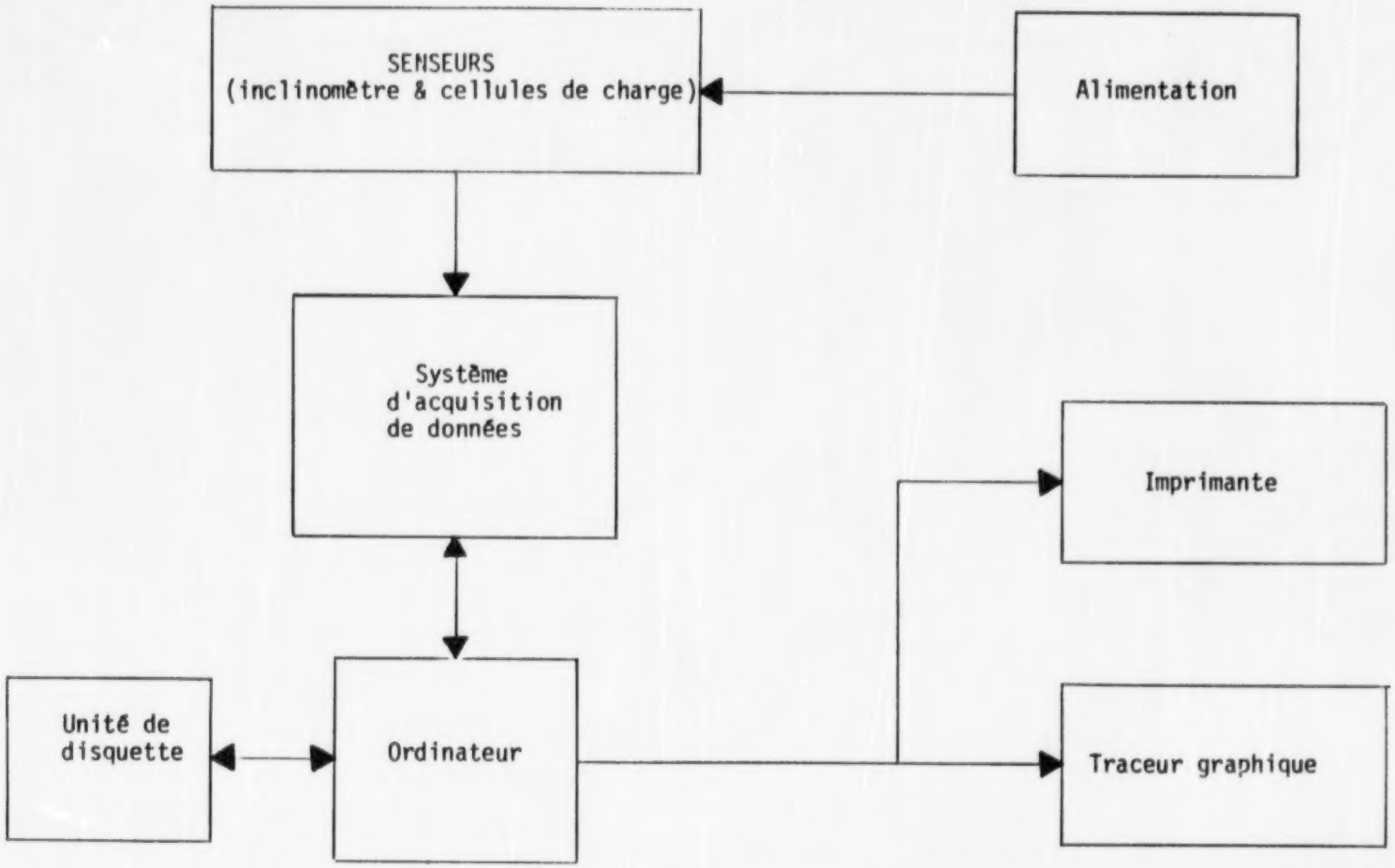
CRIQ

TABLEAU C-3

Branchements électriques des cellules de charge
(pour chaque plateau)

Position de la cellule	No de la paire de	Fil correspondant de la cellule	Position sur les connecteurs	
			24 broches	26 broches
no 2	1 - blanc	EX + rouge	A	A
	1 - noir	EX - noir	B	B
	2 - blanc	S + vert	C	C
	2 - noir	S - blanc	D	D
	3 - blanc		E	E
	3 - noir		F	F
no 1	4 - blanc	EX + rouge	G	G
	4 - noir	EX - noir	H	H
	5 - blanc	S + vert	J	J
	5 - noir	S - blanc	K	K
	6 - blanc		L	L
	6 - noir		M	M
no 4	7 - blanc	EX + rouge	N	N
	7 - noir	EX - noir	P	P
	8 - blanc	S + vert	Q	R
	8 - noir	S - blanc	R	S
	9 - blanc		S	T
	9 - noir		T	U
no 3	10 - blanc	EX + rouge	U	V
	10 - noir	EX - noir	V	W
	11 - blanc	X + vert	W	X
	11 - noir	S - blanc	X	Y
	12 - blanc		Y	Z
	12 - noir		Z	a
				b
				d

N.B.: - On trouve les connecteurs 24 broches sur les plateaux et les connecteurs 26 broches à l'autre bout des câbles.
- Le câble 24 fils comprend 12 paires de fils, un blanc marqué et un noir non marqué enroulé avec le blanc.

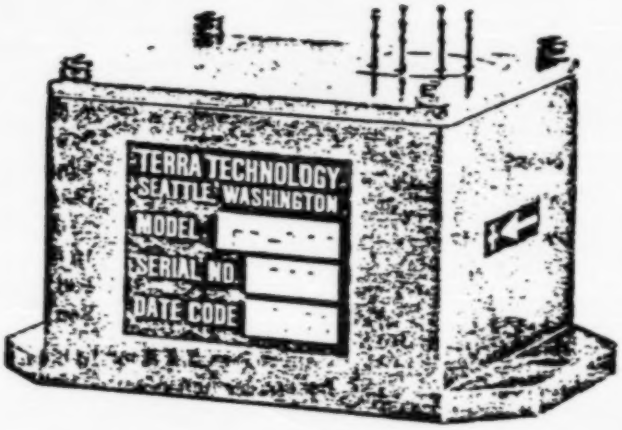


SYSTEME TYPIQUE D'ACQUISITION DE DONNEES

SERVO ACCELEROMETER

TERRA ~ FLEX® MODELS SA-102 & SA-111

INTERTECHNOLOGY INC.
11 CARSDALE ROAD, DON MILLS, ONTARIO M3B 2P2 - (416) 445-5500
MONTREAL (514) 683-0830 OTTAWA (613) 563-0522 WINNIPEG (204) 895-2037 CALGARY (403) 256-3068 VANCOUVER (604) 27.-9538



U.S. Patent No. 4,088,027

- RUGGED, FLUID DAMPED FLEXURE SUSPENSION
- LOW THERMAL COEFFICIENT
- FIELD RANGEABLE
- USER CONNECTABLE 1g BIAS
- EXCELLENT BIAS STABILITY
- TELEMETRY MODELS AVAILABLE
- CHOICE OF SENSITIVE AXIS
- BROAD DYNAMIC RANGE
- LOW OUTPUT IMPEDANCE
- WIDE FREQUENCY RESPONSE

The Terra ~ Flex® SA Series Servo Accelerometers offer the unparalleled combination of excellent stability and ruggedness. Designed for maximum user flexibility, standard features include field rangeability, choice of sensitive axis direction, and a 1g bias network which can be user connected.

A special alloy flexure system and stable differential electronic detector/amplifier are combined to provide high sensitivity, broad dynamic range, ruggedness, long term stability and extremely low thermal drift. Hysteresis is insignificant and resolution is effectively infinite. The flexure suspension, unlike pivot and jewel suspensions, is not subject to progressive deterioration in the presence of vibration and shock. Handling (peak) shock breakage, common with quartz suspensions, is also virtually eliminated.

The SA Series accelerometers operate from a wide range of input voltages and can be used for a variety of acceleration measurement applications including seismic monitoring, control systems, vibration monitoring, structural response, vehicle testing, stable platforms and tilt sensing.

SPECIFICATIONS FOR SA-102, SA-111

RANGE:[1]	±0.1 to 10g
FULL SCALE OUTPUT:[2]	±5 VDC (std) to ±10 VDC (max), ±0.5%
INPUT VOLTAGE:	±9 to 18 VDC; +18 to 30 VDC (Telemetry version only)
INPUT CURRENT:	±8 ma dual supply; 20 ma single supply (Telemetry version only)
OUTPUT IMPEDANCE:	< 10 ohm
LINEARITY ERROR:	< 0.05% full scale
HYSTERESIS:	< 0.01% full scale
RESOLUTION:	< 0.0005% full scale
TURN-ON REPEATABILITY:	Better than 50 μg
CROSS AXIS SENSITIVITY:	< 0.0005 g/g
FREQUENCY RESPONSE:	0 to 50 Hz, ±2 dB (std.), other frequency responses from 10 to 150 Hz available
NOISE: 0-50 Hz	< 5μg (peak-to-peak)
0-1000 Hz	< 10μg (peak-to-peak)
0-1 MHz	< 20μg (peak-to-peak)
CASE ALIGNMENT:	< 0.5°
OPERATING TEMP. RANGE:	-40°F to 180°F (std); -65°F to 300°F (special order)
SHOCK:	500g, 5 ms; 3000 g, 0.1 ms
VIBRATION (SINE, PEAK):	15g, 20-100 Hz; 20g, 100-2000 Hz
WEIGHT:	7 oz (0.2 kg)

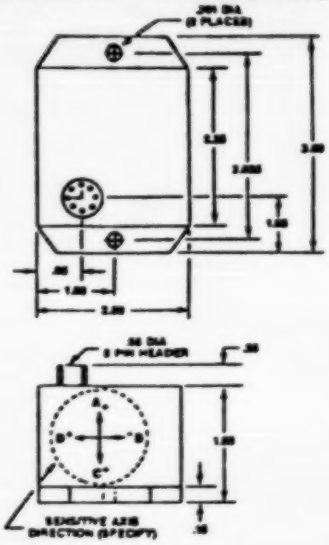
	SA-102	SA-111
BIAS, HORIZONTAL:	0.010g	0.005g
BIAS, VERTICAL:	0.020g	0.010g
HORIZ. BIAS TEMP. COEF:	50μg/°F max.	20μg/°F max.
SCALE FACTOR TEMP. COEF:	100 ppm/°F max.	50 ppm/°F max.

NOTES

(1) UNITS ARE SUPPLIED WITH 0.1g INTERNAL RESISTOR, EXTERNAL RESISTORS ADDED TO INCREASE RANGE. STANDARD RANGES ARE: ±0.1, 0.25, 0.5, 1.0, 2.0, 5.0 AND 10.0g. ASYMMETRICAL RANGES AVAILABLE.

(2) FULL SCALE OUTPUT SHOULD NOT EXCEED 10 VDC OR 75% OF INPUT VOLTAGE, WHICHEVER IS SMALLER. TELEMETRY VERSIONS SUPPLIED WITH 0-5 VDC OUTPUT.

OUTLINE DIMENSIONS (inches)



CONNECTIONS

PIN	DUAL SUPPLY	SINGLE SUPPLY
1	+ Power	+ Power
2	− Power	Power Grd.
3	Pwr. & Sig. Grd.	Signal Grd.
4†	Output	Output
5*†	1g Bias	1g Bias
6*	1g Bias	1g Bias
7	Self Test	Self Test
8	Self Test	Self Test

*Jumper pins 5 & 6 for 1g bias, no connection for horizontal operation

†Range resistor connected between pins 4 & 5.

PERFORMANCE OPTIONS

A. NON-STANDARD RANGE (Specify)

B. CASE ALIGNMENT: 1/4°

C. INITIAL BIAS: 0.002g (horizontal)
0.005g (vertical)

D. BIAS T.C. 10 μg/°F (SA-111 only, not applicable to vertical bias)

E. SCALE FACTOR TOLERANCE: ±0.1%

F. TELEMETRY OUTPUT: 0-5 VDC

ORDERING INFORMATION: Specify model number, range, sensitive direction, and performance options desired. For example, SA-102-1-B-F is a Model SA-102, ±1g, with case alignment of 1/4° and telemetry output. Full scale output is ±5 VDC unless otherwise specified on the order (except for telemetry versions which are 0-5 VDC).

WANT MORE INFORMATION? CONTACT TERRA TECHNOLOGY CORP. OUR FACTORY PERSONNEL CAN PROVIDE YOU WITH ADDITIONAL INFORMATION, WHETHER IT'S FOR A SINGLE INSTRUMENT OR A COMPLETE SYSTEM PROPOSAL.

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ANNEXE D

Photos de la table en opération

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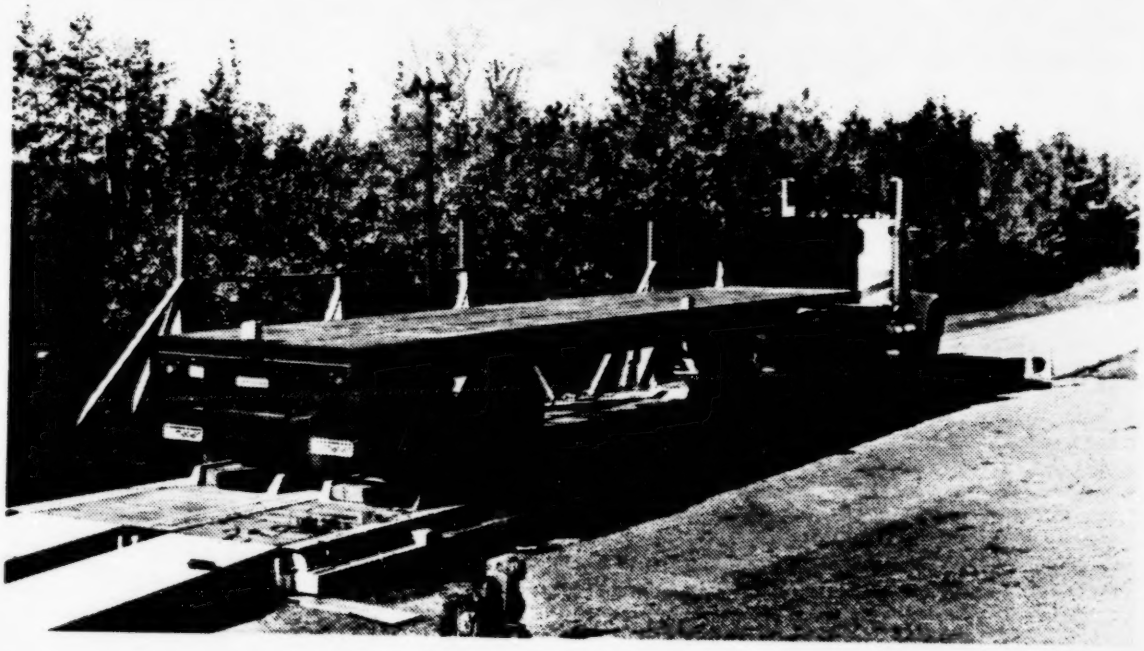

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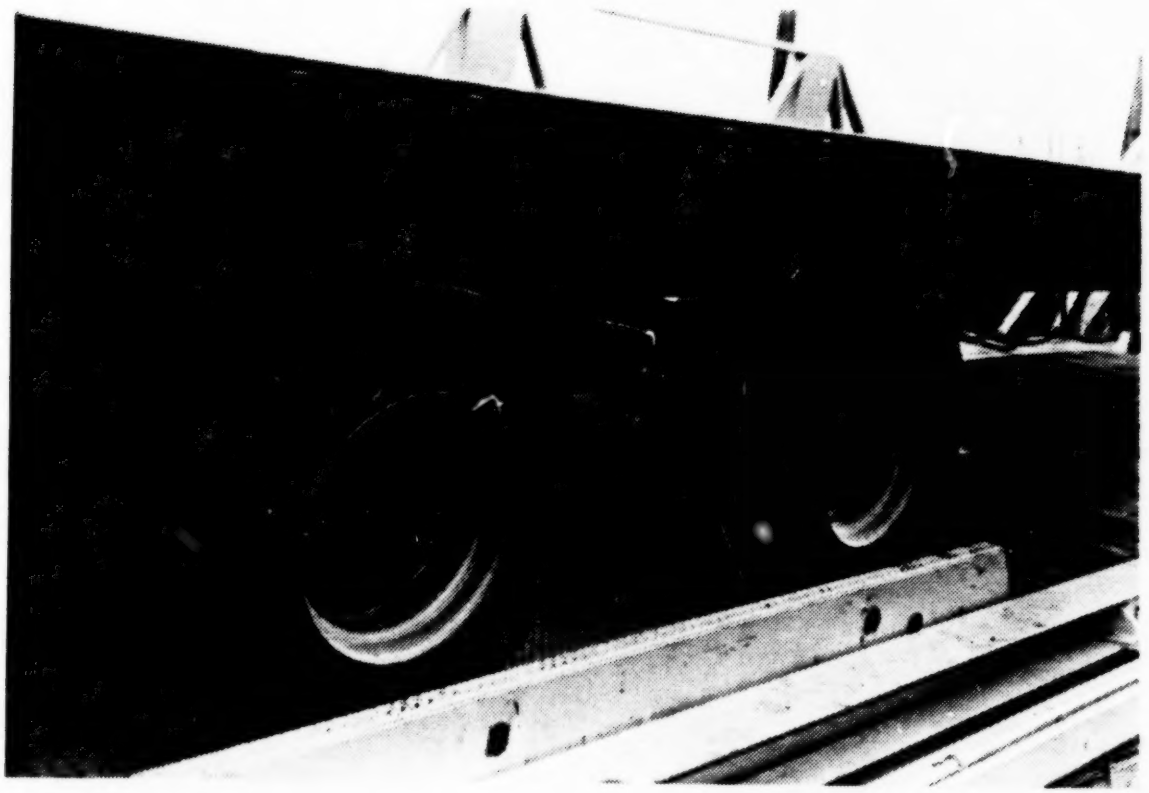

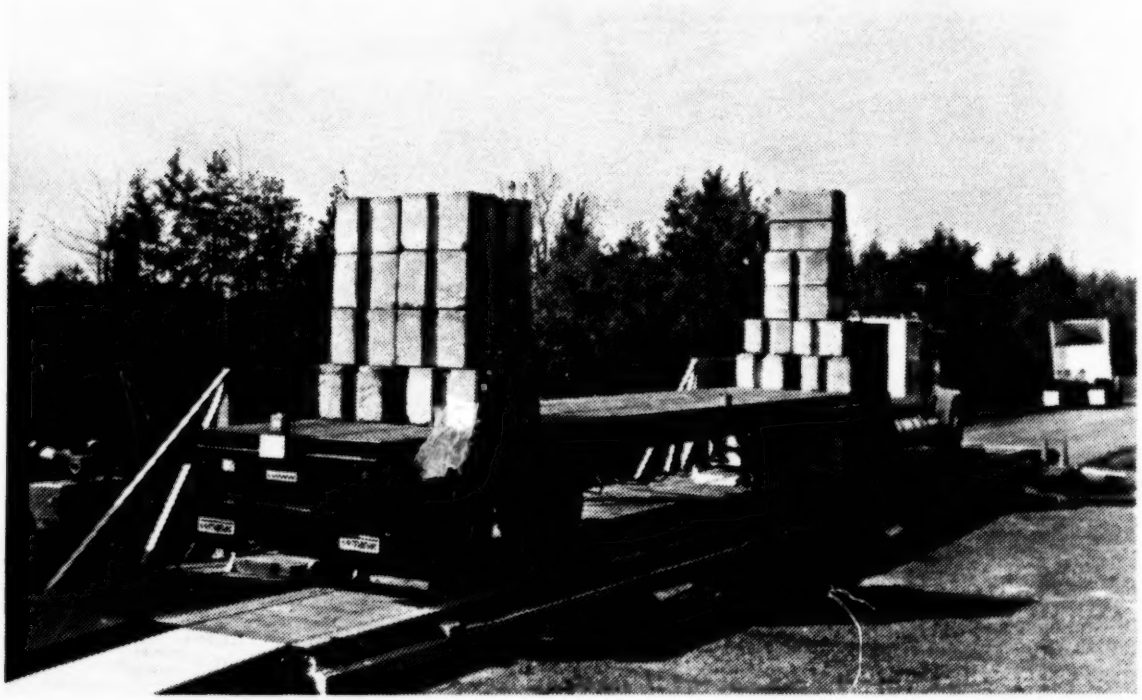

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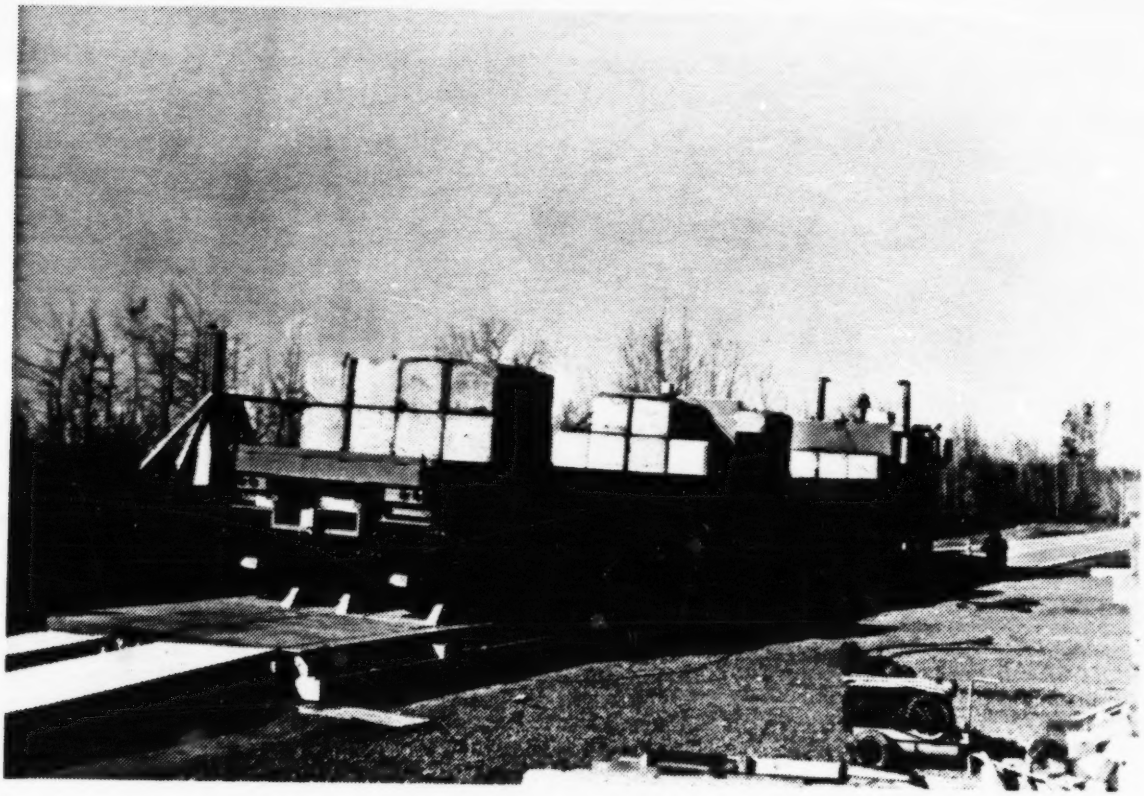

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